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ABSTRACT

This monograph summarizes 21 presentations from a symposium whose theme was technological literacy--an understanding of the impact of technological descisions. These presentations are divided into five categories. The six presentations in the section, The Context of Technology Education, focus on technological literacy for living in today's society, the state of the art, technology as a case of misplaced abstraction, technological literacy and the female student, Jackson's Mill Industrial Arts Curriculum Theory, and choice of content for technology education. Topics of the four reports in the section, Industry Perspective, include robotics in industry, publisher's role in technological literacy, protection of industrial intellectual property (patents), and computer futures. Four papers in the section, Higher Education's Response, address human productive activity as a base for industrial arts, technology literacy for the nontechnologist, transportation technology in a technology-based industrial arts program, and promoting university-industry interaction. Five presentations in the section, Junior-Senior High School Exemplary Programs, concern implications of technology at the secondary level, articulation projects in program development, program development, Wild Rose High School technology education activities, and the Oak Grove Occupational Versatility program. The final section contains two closing addresses. (YLB)

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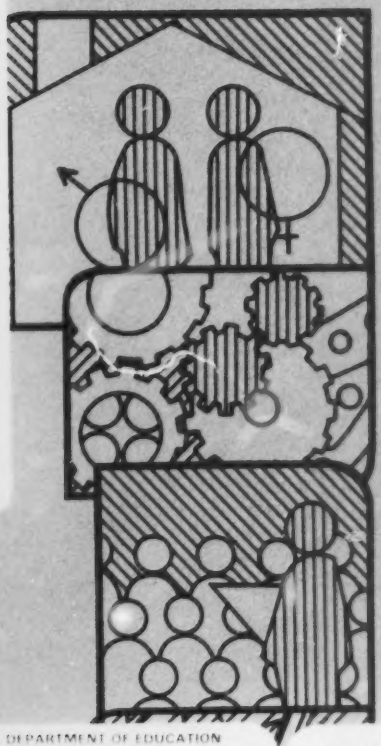
Technology Education



Symposium II

University of Wisconsin
STOUT
Menomonie, Wi

May 1 & 2 1981

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Program Theme

"Technological Literacy"

Edited By Lee Smalley

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FOREWORD

Technology Education Symposium II was a follow-up event to "Symposium '80," which was held a year earlier at Eastern Illinois University. The rapidly growing interest in Technology Education was evident by the fact that over two hundred people traveled from throughout the nation to participate in this second symposium.

Technology is "the knowledge and study of human endeavors in creating and using tools, techniques, resources, and systems to manage the man-made and natural environment for the purpose of extending human potential and the relationship of these to individuals, society, and the civilization process" (Jackson's Mill Industrial Arts Curriculum Model). Living and working in a highly technological world requires a "technological literacy" of the first order that enables us to live full and productive lives. Education, as the prime institution in our society for transmitting knowledge, skill and attitudes, is charged with the challenge of providing learning experiences and opportunities to gain this competence.

The chance to get together as a profession to exchange ideas, discuss issues, structure concepts, critically analyze developments, and to propose alternative proposals is indeed paramount in keeping our field dynamic and relevant. Technology Education Symposium II has provided that opportunity. A hearty "thank you" is expressed to those who were on the program, to those who came as participants and, of course, to Lee Smalley and his committee for hosting the event.

THE CONTEXT OF TECHNOLOGY EDUCATION

Roger Staehle	Technological Literacy - Living in Today's Society
Willis Ray	The State of the Art of Technology Education
Edward Daub	Technology: The Fallacy of Misplaced Abstraction
Donna Boben	Technological Literacy and the Female Student
James Hales James Snyder	Jackson's Mill Curriculum Theory
Dave Bjorkquist Richard Swanson	Technology Education: A Good Beat, But, Hard to Dance to!

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TECHNOLOGICAL LITERACY-LIVING IN TODAY'S SOCIETY

When I agreed to talk about the question of technological literacy, I thought maybe this subject might sound kind of dry, but it is a very exciting problem. Let me approach it in the following way. The essential objective of all human activity in any kind of a technology is to meet human needs. I mean, that is what we are all in business for. We all have the same objective no matter what kind of category we happen to be in. What are these needs? spiritual growth, food, clothing, housing, recreation, communication, transportation, security, energy and materials. These are human needs. That is the primary objective of our activity.

I think one of the exciting kinds of analogies or the exciting places to start is back with 1001 nights and Alladin. Now Alladin was able to get virtually anything he wanted by rubbing his lamp. It is worthwile to realize that Alladin was not a highly virtuous fellow. Alladin was somewhat of a profligate youth. He was not any kind of a white knight in any kind of Mideastern armor. But none the less, Alladin got what he wanted by rubbing the lamp and getting the geni, the all-powerful geni. Well, today the geni exists; it is called technology and the magic carpet, a 747.

There are three things the geni can do. One thing is to provide for each human being **infinite leverage**. Today, with the infra-red radiation from your body, you could turn a switch and send a rocket to the moon. That is infinite leverage. You press a button and you can make the most formidable and highly complex calculation on the high speed computer in nano seconds — that certainly has to be infinite leverage. So the first thing the geni does is to provide each human being with virtually infinite leverage.

The second infinitive that the geni of technology provides is **infinite vision**. Infinite vision is both a long way away and very small (long way away means 100 light years). In my college our astronomy department tells me that they can see 100 light years into deep space — near the edge of the universe, if that exists. This is the thing they get in radio astronomy. So that is one kind of dimension we can look at with infinite vision.

Another kind is to study the property of the nucleus. Now the nucleus has the dimensions of ten to the minus 13 centimeters or ten to the minus 13 centimeters or ten to the minus 15 meters — that is a very, very small number. Our physicists today can see the properties of the nucleus. We can measure the properties of the particles. We can measure their energies, charges and virtually characterize them with a device we call the Auger spectrometer. We can tell with the Auger spectrometer the composition of each element of the first atom layer to a sensitivity on the order of one part in 100,000. That is very close to infinite vision.

Finally, in another pole we can measure the properties of the body. It is now possible to put a human under what is called the CAT scan, in the medical profession, and look at a human heart beating in real time. We can remove the heart electronically in a CRT, rotate it, cut it, look inside the cavity, all in real time. The person's heart is beating inside and can be lifted out so we can watch it palpitate. That is the geni of infinite vision.

We also have the geni of **infinite communication**. It is possible with the speed of light to communicate with every human being on the planet. Through radio waves, telephone communication, television and radar, we can communicate with every human being on the planet in two-way communication. So, it is possible for us to access to the psych, soul and ideas of every being on the planet — not all simultaneously, but certainly we could if we wished. We have the possibility today of a fully connected planet, we are fully connected to our technology and so a good part of our technological literacy is to understand the properties, the accessibilities and how we can utilize the great geni of technology.

Still another way of looking at technology is to think of technology and science as a metaphor. That is, as a way of expressing another idea. Now what do I mean by that? Well, in politics we think, for example, of the concept of balance of power. My students who understand mechanics know more about balance of power than any politician who ever lived. And why is that? Because they know that you have a force over here that has to be balanced by a precisely equal force over there. We have a rotating body out here that has to be held by a centrifical force of some kind that keeps it from flying into orbit. and so intuitively our students who study science and engineering, know about the balance of power and can translate from the mechanical into the political. The students, for example, who understand elasticity again refer this to other areas. For example, we think about elasticity as having to do with atomic bonding and the flexible wings on airplanes because elasticity says the farther away I push that wing from its norm, the greater the force wants to push it back, and if I push too far, what happens? It breaks. The same is true with a society. If you push a society too far away from its norm, whether it is a norm of religion, or the norm of morals, or the norm of whatever, it wants to get back because it doesn't like to be pushed away, and if you push it too far, it breaks. And the same is true with an idea or the affairs of the spirit. The laws of elasticity and the concept of elasticity in its mathematical and in qualitative understanding, provides us with a greater insight into the process than you will find in any book on psychology, physiology, or psychiatry. And so as we understand the laws of technology and science, we intuitively understand the laws not only of social behavior, but also the laws of the behavior of the spirit. I know that seems excessively deterministic for many of you, but believe me, as you think about those things, you realize the tremendous insights that are possible, and the great intuitive capacity you have already that perhaps you never knew.

Now with all this talk about technology being the real geni, which indeed it is, it still begs the question. With this tremendous power, what do we do with it? And so the issue is not only the question of the efficiency, but also the effectiveness of the great echnological geni. The question is, who uses it and what for? And so the issue is left to make the geni more effective. The issue has to implicitly ask the question, what kind of human beings are we developing and what are they going to be using this geni for? It raises the fundamental question as we educate our students, how do we educate them? Do we educate them in an amoral sense to be totally devoid of interest in how it is used in the nature of humanity or do we ask the question about the nature of the humanity of the technologist. And so our natural inclination is to tell our students to take a few courses in liberal arts. The fact that we have studied the humanities in the cradle of Western civilization says nothing about our humanity. Today in the universities and liberal arts schools, we are teaching our students the humanities, but I am not so sure we are teaching them humanity. I think we have a very serious question about how it is we are interfacing between our technology and our humanity.

We say in the nation that we have an energy crisis. I say bologna. We don't have an energy crisis, we have a happiness crisis. The reason that we need more energy is that we have to get turned on one more time and energy is nothing but a form of chemical dependence. We say that we have a problem in big government. We don't have a problem in big government, we have problem in self government and self control. We say that we have a problem in environmental

pollution. We don't have a problem in environmental pollution. We have a problem in reverance for life, and so on. I think that we are putting more and more money into what I call the patch-up society. We are putting more money into welfare and less money into education in K-12, more money into defense and less money into teaching people how to get along with each other, more money into medicine and less money into teaching people how to eat properly and exercise, and so on. So I wonder with all of our capacity, whether the people who are educating us human beings understand their own humanity. I think it is necessary for us, as we move into an era of a fully connected planet, where we have the capacity to access the souls and psychs of all beings, we can do this for one of two reasons: either to grow as human beings or to control the planet. I think those are two awesome possibilities and where we end up between those two poles is not at all clear to me. So we have this great opportunity of technology, not only the ability to develop a geni which can certainly feed and clothe and house all of us but also the possibility to destroy ourselves, an issue that comes into the kind of humanity that we are developing.

The language of technology has to start very early. It cannot start just at Stout or the University of Minnesota. It has to start very, very early. Not to make people into technologists, for sure, but to make people into better human beings because their humanity, their enfranchisement, is directly related to the nature of their understanding of the universe of which we all are a part.

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THE STATE OF THE ART OF TECHNOLOGY EDUCATION

Whether a buzz term of the early 1980's or a significant educational movement, "Technology Education" has caught the attention of many industrial arts professional educators. Increasingly, the term is being used and debated.

In the context of manual training, manual arts, and industrial arts, perhaps the first seminal thought was provided by the Russell-Bonser Plan (Industrial-Social Theory). The work of William E. Warner and his graduate students at The Ohio State University, in four decades beginning in 1930, carried on these ideas and extended them. Delmar W. Olson's contributions to concept of technology and industrial arts were major ones.

The American Industrial Arts Association has struggled to provide leadership in promoting technology through programs and publications. Yet there remains the problem of representing the diverse philosophies of the professionals in our entire field (to maintain a support base of membership).

Several prominent projects and theories of the 1960s and 1970s have contributed to the promotion of industrial technology education or technology education. A few centers of graduate education are developing young scholars who should engage in the discussion and debate.

The USDE-VPI & SU Standards Project is in the process of producing standards which will significantly broaden the scope and character of industrial arts. The standards will call for subject matter related to "broad technological systems" of communication, construction, manufacturing, and transportation.

Three separate meetings called the Jackson's Mill Industrial Arts Curriculum Symposium were held in 1979 and 1980. Leaders debated the apparent bipolar positions of "industry" and "technology" extant in the field. An attempt was made to develop a rationale that would lead to consensus. This self-selected group of leaders has also endorsed the same set of four content or subject-matter areas: communication, construction, manufacturing, and transportation.

Of no small significance is a new series of "technology education" symposia. The first symposium was held at Eastern Illinois University in the spring of 1980. Technology Education Symposium II, convened here at the University of Wisconsin-Stout, keeps the momentum of the idea. Symposium III is scheduled for Ball State University (Indiana) in October of 1981. A fourth meeting is under consideration. Such sessions provide interested professionals with the opportunity to share their positions on current issues in the "technology education" movement. The proceedings of the Eastern Illinois University Technology Education Symposium '80 provides a number of substantive papers worthy of serious consideration.

Several questions face the profession as interested members contemplate "technology education." First, is the rank and file classroom teacher (**or** teacher educator **or** supervisor) ready for such a new departure (see Sturm, 1981)? Third, what are the differences in the constructs "technology" and "industrial technology" (see Lux, 1981)? Fourth, what are the locial subject matter divisions of technological study (see Ray, 1980)? Fifth, what are the several content selection approaches suggested by leading theorists (see Bensen, 1980)? Sixth, what are the content emphases of identified leaders in the field (see Sinn, 1980)?

Some issues that confront the profession are: (1) Should the profession adopt one and only one stipulative definition for the term "technology?" (2) Is technology a unique discipline or is it inter- or multi-disciplinary? (3) Is a study of industry or enterprise nothing short of progressive vocationalism? (4) Is the term "production" synonymous with manufacturing and construction? (5) Does the category "energy/power" qualify as a major subject matter division of industrial arts or technology? (6) Should there be a new professional organization established to study and promote "technology education?"

These and other questions and issues need to be discussed. The time is right to consider the future course of "technology education." We need to advance the "state of the art" in conceptualizing programs which will impact upon the future of young people in our schools.

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TECHNOLOGY: THE FALLACY OF MISPLACED ABSTRACTION

All who have tried to fathom Whitehead's *Science and the Modern World* will recall his phrase, the fallacy of misplaced concreteness. In that phrase he expressed his critique of the view that the objects that we perceive are out there and not also in some way right here where we perceive them. Whitehead argued that things are not so delimited in space, that they are also present in the perceiving and in the perception. I want to borrow his phrase to express my critique of many academic discussions of technology and society.

In seminars with humanists and social scientists over the years, I have found that the abstract noun technology frequently plays subject to active verbs of the genre of dehumanize, disrupt, and alienate. Hearing these claims I have often satirized such propositions about the abstraction — technology — by imagining concrete technologies in its place, coming up with combinations such as: "Stereo hifi dehumanizes;" "Refrigerators disrupt;" "Telephones alienate." Occasionally you might hear a positive note sounded by the verb to liberate but, in general I fear, technology has become the popular word, akin to the strips of fly paper in the butcher shops of my youth, for catching all that bugs Americans midst the pressures, ennui and anxiety that characterize our days. Can we meaningfully use the abstraction technology to represent the diverse technologies in our world?

This question became critical for me when I set about to prepare an address on the theme, The Technological Explosion: Can It Be Harnessed for World Development, of the Great Decisions series in 1979. The theme focused attention on the impact of new technologies in the advanced nations of the world on the less developed nations or LDC's. I found the literature replete with grand generalizations and, in a desperate search for terra firma, began to interview managers in corporations that export their technologies. After these interviews I further questioned whether we can speak any more meaningfully of **the** technological explosion than we can of technology.

As I went about interviewing, I tried to get two handles on every technology: the major new developments and their suitability for less developed countries. Among the companies I visited were three engaged in food related technologies: Oscar Mayer, American Breeders Service, and Dairy Equipment Company. What handles did I find for understanding their technological explosions and their export policies?

At Oscar Mayer I spoke with Eugene Jarrel, Vice President, International and Diversified Companies. The technological innovation in meat processing, he said, came a number of years ago following a packaging revolution - the vacuum packaging of processed meats. That revolution propelled Oscar Mayer into nationwide markets because they could now combine excellent quality control of choice Oscar Mayer products with a package that assured that quality over a long shelf life.

Although Oscar Mayer has now exported their technology to Japan in a joint venture with Prima Meat Packers Company, Jarrel doubted whether this packaging revolution would be of immediate importance to most developing countries. Meat processing and vacuum packaging can only become a viable option in a country that has established an efficient refrigeration and distribution system, an unlikely prospect in most LDC's. In fact, to its affiliate in Spain, Oscar

Mayer had found it only appropriate to introduce improved technologies in slaughtering and in the handling of fresh meat at that date.

And on that date the fate, the slaughterhouse hung heavy over the bulls at American Breeders Service, for the day I headed north to ABS from Oscar Mayer was the very day that the USDA sire summary came out, the computerized compilation of the tests conducted to determine the milk productivity of the daughters born by artificial insemination (AI) from these promising sires. This progeny test takes 5 years, and the computer generates a number known as the predicted difference (PD) for each bull. This is the predicted difference in milk productivity from the daughters they might sire in the future. On that number hangs their fate between the slaughterhouse and continued air-conditioned comfort.

Bob Pelkey, Director of the International Division at ABS, reviewed the stages in the technological explosion that led to world wide distribution of genetic information via AI. It began in 1950 when *Nature* announced that British researchers had succeeded in their experiments to dehydrate spermatazoa with a chemical mixture in glycerol solution, then to freeze the mixture, and finally to bring the spermatazoa back to full motility after thawing. By 1953 ABS had produced the first calf born from frozen semen in the United States, and by 1955 ABS had co-developed the liquid nitrogen refrigerator, a sophisticated steel thermos that insulates the liquid nitrogen that bathes the AI ampules. With that device individual farmers anywhere in the world can keep their own chosen varieties of AI ampules because the nitrogen supply will last 16 weeks.

So the combination of PD and AI, progeny testing for the predicted difference in milk production plus artificial insemination with semen from bulls who pass the test, promises dairy farmers that they will be raising cows with improved productivity. Is that important for LDC's? It certainly is for those who are trying to increase their milk production by importing the highly productive milk cows that we have developed. Dairy cow breeders have increased milk production per cow from 3,000 pounds of milk per year to 14 or 15,000, and Wisconsin exports more than 10,000 cows every year to countries seeking self-sufficiency in milk production. And, in order to cope with such rapid increases in productivity, milking machines became almost a necessity, and that led me to Tom Erbach, Export Coordinator at Dairy Equipment Company.

The simplest machine, he said, is called a bucket milker, a milking claw with an attached bucket. This has been markedly improved, however, with a recent technological innovation, a device that automatically releases the milking claw when the cow's milk flow reduces to a level that indicates she should no longer be subjected to the milking action. Trained milking people can make this judgment by watching the amount of milk flow through a window in the claw, but not when they operate as many as 8 claws at once. Only the automatic release mechanism can protect the cows from overmilking and the consequent damage to their mammary tissues, and the danger of mastitis, an infection of the mammary glands.

These samples from my visits to corporations engaged in technological change and the export of their technologies show clearly that we cannot speak meaningfully of **the** technological explosion because the true picture is more like the grand finale at the traditional 4th of July fireworks. It reinforces my point about technology as a case of misplaced abstraction.

I wonder whether we should banish the word technology from serious discourse because the diversity of technologies forbids their inclusion under a single abstract noun. Failure to do so will continue to condem our attempts at interdisciplinary dialogue. We will still be confined to discussions that often represent mere wrestling in rhetoric, where the honors that accrue to the winners can best be paraphrased by the slogan at the American Breeders Service, "Our bull goes farther."

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"TECHNOLOGICAL LITERACY AND THE FEMALE STUDENT

People who desire to become full-fledged particpants in the American way of life must learn to cope with our complex technological society and culture. Central to this coping is being exposed to experiences which contain elements of American economic life.

Historically, women have always participated in all facets of American life, but their acceptance as serious, intelligent and contributing members to the society has been questioned. Since the first organized meeting for women's equal rights was held in Seneca Falls, New York in 1848, women and men, have led long and sometimes bitter struggles to attain economic and political equality for women. The passage of the Nineteenth Amendment to the Constitution, which gave women the right to vote, and the steadily increasing numbers of women into the paid labor force are the two most significant events of the 20th Century enabling women to function as total participants in American society.

However, these two events have not eliminated the barriers which have, and still are, preventing women from gaining the technological literacy needed to cope satisfactorily with American's complex technological society.

The results of technology have affected and continue to affect women's daily lives. Technology has been influenced, and is influenced, by both the culture and economy of this country, thus affecting the way both women and men work and play and think.

As women become more intricately involved with the economy as producers and consumers, as well as participators in recreational activities, it is of utmost importance that they are provided the technological literacy and understanding of our total enterprise system.

Data which documents women's enrollments in technologically-based educational courses at junior and senior high school levels, and programs at college and university levels reveals that participation is minimal to almost non-existant. Labor market data reinforces the absence of women in careers requiring knowledge of industrial technology.

In a time which promises, at the very least, a contraction of women's rights, the analysis of the techno-economic imperative may be one of the few routes still available for addressing women's concerns and ensuring them full participation in the American economic and political systems.

Industrial arts, as a subject area of the school, stands in a critical position to deliver broad-based economic and technological understandings to females, as well as males, at all levels of education. It can provide the technological literacy which females need to understand the totality of our enterprise system.

Special thanks is extended to the following people for providing excellent resources for the preparation of this presentation:

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JACKSON'S MILL CURRICULUM THEORY

We are privileged to be living in one of the most exciting periods of time known in the history of humankind. We are constantly made aware of the changes taking place in our world through instant global communications. We are able to travel to beforehand unthinkable places, arriving before we leave, through the marvels of supersonic transportation. We are able to move mountains, create new waterways, and otherwise alter our environment through new construction techniques. We are able to improve the quality of our life as we manufacture new products which reduce the burden of human labor.

In coping with the problems of human existence, people have created societies that are diverse and complex. Therefore, the institution of education has been established as a societal process with the goal of understanding and enhancing human potential. The educational system is charged with the responsibility of preparing children to assume a constructive role in a changing world. The various disciplines within the educational system are established around a body of knowledge which has purpose for the learner. This purpose is expected to be learned, assimilated, and transmitted into purposeful activity by the learner demonstrating his/her ability to contribute to and participate effectively in society.

Industrial arts, as one of the disciplines of schooling, has a body of knowledge which can be identified, contributes to technological literacy, and enhances human potential.

In reflecting on the term Industrial Arts, one becomes aware of the variety of connotations which it implies. Hence, in order to establish the necessary perspective, a definition of industrial arts is presented:

> Industrial arts is a comprehensive educational program concerned with **technology**, its evolution, utilization, and significance; with **industry**, its organization, personnel, systems, techniques, resources, and products; and their social/cultural impact.

To further clarify the definition, **technology** is considered as the knowledge and study of human endeavors in creating and using tools, techniques, resources, and systems to manage the man-made and natural environment for the purpose of extending human potential and the relationship of these to individuals, society, and the civilization process. **Industry** is considered as that section of the societal economic institution that utilizes resources to produce goods, services, and information to meet the needs and wants of individuals and society. Thus, the emphasis is on the human element - human endeavors.

This project provides a foundation for reconciliation of the divergence which exists within industrial arts - industry and technology. It also provides a focus on that which is unique to industrial arts in the educational process - our body of knowledge.

The Jackson's Mill Curriculum Theory highlights the interrelationship of philosophy and classroom practice. The focus of industrial arts programs has often been reflected more in the physical setting rather than in a well defined philosophical statement and systematic analysis of content. Philosophy and curriculum base, however, are in and of themselves not enough. Concepts, competencies, and learner outcomes must also be clearly identified. A systematic se-

quence of events - rationale, objectives, pre-assessment, instruction, self-evaluation, evaluation, and feedback has been suggested to serve as organizers and should be followed in the content development process.

The stage is thus set for a far-reaching and imaginative period of curriculum development in industrial arts. There is a need to proceed from this curriculum theory toward the development of state plans for industrial arts, development of curriculum guides from the models, staff development packages for implementation, field testing of curriculum materials, revision of teacher education programs, and the development of articulation publications.

It is clearly evident that this curriculum theory does not present all the answers. It does, however, represent the best effort and consensus of those among us who participated in the Symposium. The implications are clear and the foundation is laid for the reconstruction of industrial arts as a building block toward technological literacy. Our hope is that the American Industrial Arts Association will provide the professional leadership toward continuing the Symposium as a major and ongoing source of dialog and focus for change.

To obtain a copy of the Jackson's Mill Industrial Arts Curriculum Theory, you may write to one of the authors.

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TECHNOLOGY EDUCATION: A GOOD BEAT, BUT, HARD TO DANCE TO!

Parameters of Technology

We're not against technology. We're not against the concept of technology education. We've served as consultants to several Fortune 500 companies including a manufacturer of building materials, an oil company, and the technological leader in the design and manufacture of heart pace makers. These experiences, combined with the fact that we work in a major research university with hundreds of competent researcher-scholars that are advancing the frontiers of their technological specialties keeps us humble when we talk about technology. This humility leads us to what we believe to be a reasonable thesis. This thesis is that:

> Technology is bigger than any one field of study and it is presumptuous to think that industrial education can lead or reflect technology beyond some very limited view. The limiting factor that we must wrestle with is industry and probably a narrow slice of industrial technology at that.

We believe that it is safe to say that the parameters of technology at the conceptual level are quite manageable. Several generalizable conceptual models of the characteristics or elements of technology are available and are useful cognitive organizers for much human activity.

The practical problem arises with the impotency of such conceptual models in dealing with technology in a substanital way beyond feeling the roar of its engines or becoming familiar with its general characteristics (Toffler, 1970). Specific technology is everywhere . . . technology of cooking, technology of criminal investigation, technology of motivating workers, technology of appendix removal, and the technology of welding just to name a few (Lux, 1981). Each has very unique methods. The all-inclusive general technology models or methods and their limitations lead one to poor solutions in any specific domain (Swanson, 1981). They certainly don't result in the likes of space shuttles or even a space shuttle hypothesis.

Thank goodness most of the global rhetoric about technology among industrial education personnel (e.g. technological literacy, technology as instructional method, and technology as a social force) is largely ignored by these same persons when they implement curriculum. Lacking any powerful tool to analyze technology, they usually make gigantic intuitive jumps back to the confines of their experience. They talk of communication, production (manufacturing-construction), energy-power, and transportation (Devore, et al, 1979; McCrory, 1980; Eensen, 1980). And, even then, these components are usually narrowly defined in ways that most industrial educators with an ounce of objectivity could say "Yes, I teach, or could teach, that stuff!" The proposals of the avant-garde technology educators of today look almost identical to models of industry (not technology) presented in previous decades (Swanson, 1971; Yoho, 1967).

Yes, technology and technology education are very important. Industrial education should be a major contributor to presenting accurate and useful information about **industrial** technology to learners.

Perspectives of Technology

As industrial educators we have tended to be hardware and technique oriented in making decisions about what we will teach. This is also a dominant theme in technology education underscored by the more sophisticated hardware and technique around us (Bensen, 1980). If a machine can perform 10 operations we feel compelled to teach all 10 without judging the relative importance of each of them. Because technology is advancing, many technology educators attach an urgency to keeping up with the hardware rather than to separating the important from the less important content to be learned. It is unfair to learners and instructionally unsound to give equal attention to all that can be learned. There is need in technology education for a decision making system that will help in identifying content based on its importance to learners.

The learners, rather than any single dimension of technology should determine what is to be taught. At the other extreme from hardware, the futuristic orientation of much technology education does little to deal with many of today's immediate problems. Student's present needs cannot be ignored from the standpoint of their motivations and the problems they face now. At the same time we must recognize that they will live in an unknown future.

Any attempt to prepare for the future needs to give a firm grounding in the knowledges and skills of today. Content that is worthy of teaching should be taught well. This is the base on which new learning will be built. The future is not going to begin with all new knowledge and skill. Technology is not something new that was just sprung on us. It has been assumulating since the beginning of humans (Pytlik, et al., 1978). Our learners and our teachers in the field do not come to us ignorant of technology.

Learning does need to be made more efficient and it can be aided by applying technology to it. The tools of technology are not adequately applied to technology education. Methods of problem identification, analysis, organization, data gathering, and field testing are not applied often enough to instruction in technology education. There is also technological equipment that can be used in making instruction more efficient.

We cannot fail to remember that we are a field of study that serves students of all academic abilities. The majority of our students will graduate in the lower one-half of their classes. As technology advances it becomes more abstract and more difficult for many to learn and inappropriate for some learners. The glamor of working with advanced technology should not leave students behind to fend for themselves.

Definitions of Technology

To define something is (1) an act of determining or settling the limits, or, (2) making definite or clear (Webster, 1979). Probably the clearest and most definite statement about technology is that there is no widely held universal definition of technology. Recognizing the underlying constraints of technology when defined as hardware, technique, organization, or social force is very useful in communicating to and about technologists (Swanson, 1981).

Dictionaries are an account of how words are used. Revisiting the dictionary of the authors' youth portrays a simpler time with 1953 technology being defined as "that branch of knowledge which deals with the various industrial arts; the science or systematic knowledge of the industrial arts, as spinning, weaving, dyeing, metal-lurgy, brewing, and the like" (Webster, 1953). Today's interpretations of technology include everything from behavioral control technology to sports technology.

Defining technology is important, but, one must recognize that definitions of technology grounded in philosophy, conceptual logic, or limited experience will not suffice. There is too much emotion being attached to the word. Each definition that is tauted, if it is to be useful to the scholar of technology, must be empirically validated and revalidated over time to substantiate the limits of technology. The use and/or development of tools to intelligently describe technology is largely being ignored by avant-garde technology educators. As noted elsewhere in the literature, weak definitions insure poor solutions (Luftig, 1980; Swanson, 1981). The problem in defining technology transcends words into the realm of invesigation methods. The investigation methods of avant-garde technology educators are to this point largely superficial introspection. What investigative methods will they propose? What are their sources of invalidity? What is the reliability of the various investigative methods and their concurrent validity? These and other important methodological questions need to be asked and answered before one delivers an "alter call" to the profession. Pamphleteering should only follow careful and successful research that has yet to be completed.

Industrial Education's Role

In the desire of technology educators to do new and better things, the present strengths of the field should not be forgotten or rejected. As defined by some, technology education is very broad and lacking in focus (Wright, 1981). There isn't clear direction given by present definitions and descriptions. As a result there is some wandering into instructional domains that are better served by others. Some want to make technology education more mathematical, scientific, and engineering (Lux, 1981). Others want to justify it on the basis of what it will contribute to the learning of other subjects. These and other attempts to make the field more academic have taken us away from what we can do best.

There is an implicit assumption that in an interdisciplinary technology education program, the people with backgrounds in industrial education will be the managers of the system. This management position for the industrial educators is not openly accepted by other potential team members.

Because we perceive that important topics are not being taught in other subjects we cannot take them over in industrial education. Social organization and values become central in technology education (DeVore, 1980). There is no reason to think that we can do a better job of teaching these subjects than those specifically prepared to do so. It would make as much sense for social studies teachers to teach industrial education.

The real loss, resulting from the lack of focus in technology education, is in the content that is no longer taught. Industrial education is valued in the community and the schools for some things that it has done well. We are known as developers of psychomotor learning because we have done it with care and attention to detail as no one else has. We have been successful in teaching students with limited learning ability. We have provided concrete learning experiences and have motivated many "turn-off" students. We have taught about the world of work, relationships among people, responsibilities and authority, and how things get accomplished there. Mostly we have taught about industry and its tools, materials, and processes. There is no one else in the schools to do that. There is reason to be proud of what we do in industrial education and no doubt there is a need to do better than we have in the past. The shift to technology education will not in itself alter the demands for quality performance in the profession.

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INDUSTRY PERSPECTIVE

Roy Hyink	Robotics in Industry
Gerald Stashak	Technological Literacy: The Publisher's Role
Donald Schultz	The Protection of Industrial Intellectual Property
Earl Joseph	Computer Futures: Beyond the Next Five Years

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ROBOTICS IN INDUSTRY

This morning I wish to discuss:

1. Where are robots being used today?
2. Where are they in evolutionary process?
3. What does the future hold?

To provide an orientation, I would like to show you a video tape which shows some scenes fo actual robot applications. As you will see this tape is one prepared by the Robot Institute of America, a group of the Society of Manufacturing Engineers.

As you watch this tape, please note the four types of applications described.

1. Material Handling
2. Hazardous Locations
3. Special Applications
4. Greater Programmability

The definition of a robot is. "A Robot is a reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices, through variable programmed motions for the performance of a variety of tasks."

In order to provide a little more structure to the subject of types of jobs for which a robot is suitable, I would like to refer to the definitions of complexity levels of various tasks taken from the Dictionary of Occupational Titles, fourth edition 1977, U.S. Dept. of Labor (pages 1369-1371). The most complex task is level 0 while the most simple task is level 7.

0. SETTING UP: Adjusting machines or equipment by replacing or altering tools, jigs, fixtures, and attachments to prepare them to perform their functions, change their performance or restore their proper functioning if they break down. Workers who set-up one or a number of machines are included here.
1. PRECISION WORKING: Using body members and/or tools or work aids to work, move, guide, or place objects or materials in situations where ultimate responsibility for the attainment of standards occurs and selection of appropriate tools, objects, or materials, and the adjustment of the tool to the task require exercise of considerable judgement.
2. OPERATING-CONTROLLING: Starting, stopping, controlling, and adjusting the progress of machines or equipment. Operating machines involves setting up and adjusting machine or material(s) as the work progresses. Controlling involves observing gauges, dials, etc., and turning valves and other devices to regulate factors such as temperature, pressure, flow of liquids, speed of pumps, and reactions of materials.
3. DRIVING-OPERATING: Starting, stopping, and controlling the actions of machines or equipment for which a course must be steered, or which must be guided, in order to fabricate, process, and/or move things or people. Involves such activities as observing

gauges and dials; estimating distances and determining speed and direction of other objects; turning cranks and wheels; pushing or pulling gears, lifts or levers. Includes such machines as cranes, conveyor systems, tractors, furnace charging machines, paving machines and hoisting machines. Excludes manually powered assisted machines, such as electric wheelbarrows and handtrucks.

4. MANIPULATING: Using body members, tools, or special devices to work, move, guide, or place objects or materials. Involves some latitude for judgement with regard to precision attained and selecting appropriate tool, object, or material.

5. TENDING: Starting, stopping, and observing the functioning of machines and equipment. Involves adjusting materials or controls of the machines, such as changing guides, adjusting timers and temperature gauges. Turning valves to allow flow of materials, and flipping switches in response to lights.

6. FEEDING-OFFBEARING: Inserting, throwing, dumping, or placing materials in or removing them from machines or equipment which are automatic or tended or operated by other workers.

7. HANDLING: Using body members, handtools, and/or special devices to work, move or carry objects or materials. Involves little or no latitude for judgment with regard to attainment of standards or in selecting appropriate tool, object, or material.

Now we begin to get the feel that presently available robots can be used for tasks from 3 through 7 but hardly can be used for 0 or 1. Task number 2 seems to be at the edge of robot capability.

Next I wish to talk a bit about what types of robots exist today and follow that with what is the future of robots.

Robots are powered by electric, hydraulic, or pneumatic energy sources. Of course, electric motors seem the most simple and straightforward; and indeed they are used on the most versatile robots. However, electric robots have less power than hydraulic robots. Pneumatic robots fall between the two with very simple power source and cylinder construction. ASEA of Sweden markets the largest electric robot; other producers of electric robots are Unimation, General Numeric, Reis Machines. In general, these robots are more expensive than the hydraulic robots but they have better repeatability. Selection of the proper robot must depend on the actual application.

Pneumatic robots generally consist of combinations of linear actuators using mechanical stops for final positioning. This results in the lowest cost robot which is programmed with a wrench in the actual application. This results in the lowest cost, least sophisticated robot.

The control of these robots varies from simple limit switch and/or relay control systems to sophisticated stored program computers. For instance, the Unimate and the Binks have a system in which the unit is programmed by moving the arm through a sequence of operations while the controller is in the "learn" mode. The movements are stored in a memory so that the robot can repeat the movements on demand. In the case of the Nordson painting unit, it is possible to store up to 10 to 20 programs. Then as pieces come along on the conveyor hooks, a series of electric eyes and limit switches identify a particular part. The proper program is recalled from memory and the robot properly paints the part as previously programmed. These types of robots are probably the most flexible and versatile.

Now let's talk a little about the future of robots. The newest developments taking place in robotics is in the field of sensors. In particular visual sensing is being developed rapidly. This is being done with a complete picture of the field and with enlarged pictures of particular parts of

an object. Pattern recognition techniques are then used. Tactil or touch sensors are being worked on. Structured light is being used. All of these advanced sensing techniques are being developed rapidly.

These advanced sensing techniques are developing as part of expanded use of microprocessors and microcomputers in robot controllers. The explosion, or I should say, implosion in logic capability on a chip is permitting distributed intelligence close to sensing functions. This si also permitting several robots or combinations of machines and robots to be combined in one manufacturing system.

Next let's consider some of the statistics of robot usage.

	Type A	B	C	D	E	Total
Japan	3,000		11,000		33,000	47,000
West Germany	300	150	200	200	5,000	5,850
United States	1,810	345	1,100	*	*	3,255
England	60	85	20	20	*	185
Poland	70	40	200	50	360	720
Belgium	7	3	*	3	7	20
Sweden	450	120	*	*	*	600
Norway	20	20	100	30	30	200
Finland	20	10	70	10	20	130
Czechoslovakia			1	1	3	5
Netherlands		25	10			35
Denmark	20	8	30		100	158

*Figure unavailable

Type A: Programmable, Servo-Controlled, Point-to-Point
Type B: Programmable, Servo-Controlled, Continuous Path
Type C: Programmable, Non-Servo Robots for General Purpose
Type D: Programmable, Non-Servo Robots for Die Casting and Molding Machines
Type E: Mechanical Transfer Devices (Pick-and-Place)

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TECHNOLOGICAL LITERACY: THE PUBLISHER'S ROLE

Before discussing the publisher's role in technological literacy, I would prefer to briefly discuss the publisher's role in the eudcational process. By so doing, I think you will have a better understanding of how Davis became involved with the development the Technology Education program and why we are represented here talking about technological literacy.

Students, teachers and instructional materials, when viewed as a whole, offer tremendous potential for valuable learning experiences. To utilize this potential certain assumptions must be made that:

1. **students** are active learners.
2. **teachers** are willing to meet the challenge of teaching all students - gifted, talented, slow learners, etc.
3. the **publisher** is motivated to develop instructional materials that help the teacher and inspire the student.

Traditionally, the publisher's role was one more of reaction rather than action. A direction was defined; a need was identified; a market was developed. All of this was done by the educational community. Once this occurred, the publisher provided materials that teachers had basically developed. As a result, you had books or educational materials that "reflected" the school curriculum. Because it did so, there was little problem making the educational materials "fit." Examples were - and are - McGuffey's Readers, Dick and Jane reading series, industrial arts books of the 30's, 40's, 50's. Unfortunately some of the latter are still being used today.

In recent times publishers have assumed a more active role. With educational leaders, publishers have been willing to take the risk by basing publishing decisions on "developing" trends and directions; i.e., Biological Science Study Group (BSSG) and Industrial Arts Curriculum Project (IACP).

And, now, publishers are very often in the forefront of innovative curriculum ideas.

The Technology Education Program by our company, Davis Publications, is an example of this and one that applies more directly to this group.

A feature of the Davis Publications Technology program - as well as all Davis' books - is literacy. In this case, technological literacy.

Technological Literacy

Let me offer the following quotes.

". . . the United States is in danger of becoming a nation of technological illiterates, unable to understand or make informed decisions about the evolving high-tech culture . . . Having raised the issue, Washington can now respond by funding teaching positions and sponsoring Technology textbooks."

"Let us hope, all of us in the educational community are aware of the need to respond. We can no longer say that we must make changes in the decade ahead . . . This means constant

re-education for the teacher, yearly re-evaluation of courses, areas of study, and alertness in all directions."

No - these quotes are not from our sales literature. The first is from a Long Island (N.Y.) newspaper. The second is from a newsletter put out by the Nassau County (N.Y.) Industrial Arts Teachers Association in response to the first quote.

The Technology Education Program

By being technologically literate, we believe, students will be able to:

1. Contribute to the **advancement** of technology.
2. Be better able to **assess** current and future technology.
3. Be better able to **control** technology.
4. Be better able to **adapt** to their changing world.

All of this adds up to the intelligent use of technology for all humans - now and in the future, in developed and developing countries.

For example our materials place considerable emphasis on attaining "literacy." An examination of the student materials would reveal that we include vocabulary lists, glossaries, facts about technology, issues, values, etc. We discuss systems; we encourage students to think about technology in terms of a system.

We also encourage active student participation. For example in chapter 5 of the book, *People Create Technology*, we discuss the procedures of technology. As might be expected we define a procedure, apply it to specific areas, discuss a procedure, etc. But we go a step further, we talk about technological outcomes - a result that occurs when a procedure is used. We talk about outcomes in terms of goals, products, services, careers, and new technology. We note the pro's and con's of each type of outcome. We discuss specific applications of the outcomes. We include in the questions and terms sections specific activities to reinforce an understanding of the term, outcome.

The materials for teachers encourages teachers to include assessment procedures to measure literacy based on the content of a given publication. As in the student materials, the teacher materials include extensive resource lists which would enhance technological literacy. More specifically, in the teacher's guide we provide 12 questions which would aid teachers to evaluate student understanding and application of the term, outcomes.

In the outline of goals for the chapter we include several additional "teacher-centered" activities that, if used, would reinforce student knowledge of outcomes. There is more but rather than bore you with details allow me to summarize our guiding philosophy. Students who use our materials are going to be the people who will be tomorrow's consumers; they will be tomorrow's elected officials; they will be tomorrow's electorate.

If we are going to expect these students to be able to make intelligent choices - as consumer and as citizens, then we want to have a citizenry that is well-informed and, hopefully, familiar with the language of technology.

We do not presume that every student using our materials will be an astronaut, or a bricklayer, or a teacher, or a clerk, or what have you.

We do presume that all of them will be consumers; that all will be earning a living; that all, at some time, will be called upon to make choices as to elected officials, life styles, etc. That all, in their lifetimes, may make several career changes.

If we do nothing **else**, we hope that these "future adult citizens" will at least become familiar with the "language of technology" - an informed citizenry able to discuss the "pros" and "cons" of new developments, innovations, and inventions. An informed citizenry that will be able to meet career challenges head on.

In summary, they will be technologically literate. They will be so because **we,** as publishers, and **you,** as teachers, have done our jobs.

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THE PROTECTION OF INDUSTRIAL INTELLECTUAL PROPERTY

The concept of property rights and title, along with the development of man as a trader, led quite naturally to the establishment of rights to intellectual property. The protection of industrial intellectual property encourages thrift, risk-taking and investment. Investment promotes development of technology and growth of industry, and subsequent creation of jobs.

Thrift and investment, without commensurate potential for reward of some kind or another, are extremely unlikely. Since much of industry evolves from intellectual property, our founding fathers had the foresight to provide for the development of a patent system in the Constitution of the United States. The granting of Letters Patent carries with it the provision that a disclosure of the technology be made public. In return for such public disclosure, the inventor, or his assignee, is granted the right to **prevent other** from making, using or selling such invention for a limited period of time. The information disclosed adds to the public knowledge and provides a means for building technology on that public information.

Other means available for the protection of industrial intellectual property will be described and discussed briefly. However, the most common means, Letters Patent, will be discussed in some detail under the topics:

1. Definition of a Patent
2. Types of Patent
3. Requirements for Securing a Patent
4. Process of Obtaining a Patent

Several industrial examples will be described, and the results of such protected property rights will be presented.

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COMPUTER FUTURES: BEYOND THE NEXT 5 YEARS

This information age is upon us; in some parts of the world, for example in the U.S.A., over half of the work population now works at an information related job. Thus, information technology is flourishing - and as would be expected, new tools and appliances for assisting us and for amplifying what we do in this new age are appearing.

When we were in the agricultural age the gang plows, reapers, combines, manure spreaders and irrigation machines (etc.) hit the scene to amplify farm workers and the output of farmers. These mechanical machines drastically raised the productivity of farmers via automation without computers. The result was a trajectory from over 90% of Americans working directly on the farm, a few hundred years ago, to now with less than four percent of our population working directly on the farm. In the industrial age, a recent age that for some parts of the world (the U.S.A.) already belongs to our past heritage, machines for raising the productivity of people were introduced like lathes, welding machines, riveters, punch presses, milling machines, numerically computer controlled machines, and now robots, (etc.) that altered the infrastructure of our society by molding it into the industrial age from the agricultural age. The result brought the number of people working directly in the factory from over 50%, at the "height" of our industrial age, to the present with only 17% of our work force working in the factory - and this is expected to fall rapidly in the eighties. Now in this new information age that we have recently entered, new tools and new appliances are coming into use for amplifying what society does, usually in offices for handling information, and for opening the door to greater information access. These new tools are also finding application for raising both the productivity of people in offices and the use (and access) of information everywhere - including in the home, in education and in defense.

Information age automation tools and appliances for raising the productivity of people starts with computers - a tool which emerged from the industrial age that speeded its demise and at the same time helped create the new age of information dimensions. Today the new "engine of change," for embedding into machines for making them smarter in handling information, and increasing productivity through automation is the microprocessor silicon SI (Large Scale Integration) or VLSI chip. Computers, word processors, and the like, as they are forecasted to evolve into future information technology, portent to provide future business, education, governments, professions, offices, farmers, industry, managers, politicians, and institutions with increasing information access. They provide expanding techniques and methods to help sense, measure, acquire, store, process, manipulate, associate, retrieve, disseminate, communicate, and apply information. They also assist in turning information into real-time applicable knowledge that is applied at the time it is needed.

This paper reports on initial research into a variety of new computer architectures. If the river of future history runs its present course for the 1980 decade, as carved by the 1970s past years, then computer developments will be cast in the image of the past without a new generation architecture. But then again, such a trend is in all probability ready for a major change - a change most likely future, then it is also apt to follow the general societal trend of the growth in diversity - foretelling an era of a multiplicity of architectures in side-by-side existence in the future rather

than the rut of the past where conformity and mass sameness raged. Now the embedded microcomputer allows each system in the future to be different and programmably constantly adaptable. The basic rationale or impetus for the scientific investigation and the downstream development of alternative new computer architectures is multifolded, namely:

1. Scientific advances from other fields are rapidly developing new knowledge which is translatable into new computer architectures or processes - for example, from brain research and the new genetics of recombiant - DNA gene splicing. In fact, in the last decade we learned more about the brain and the "DNA program of living systems" than throughout all of history preceding the 1970's. Thus, computer architectures can now be designed to infer, discover, learn, imitate human brain functions, and solve problems rather than just executing streams of instructions. That is, we can now make artificially intelligent/smart machines.
2. Very large scale integrated circuit silicon chip components (VLSI) design aesthetics - we are approaching the capability of putting a half of a million to a million logic circuits into a single silicon chip component; just a few years ago, a few thousand circuits was a lot.
3. To ease (and shorten) the so-called program and programmer problem, i.e., tailored architectures which better fit program and/or programmer needs, or architectures that by-pass the need to program computers.
4. Post-modern computer/calculator movements toward the new humanism is making convivial and symbiotically systems that are easier to use and fit more compatibly within society, th environment and with our resources.
5. The application need (technological, economic, performance, reliability, etc.), and the market potential for novel and specially tailored systems is large and rapidly growing larger - especially as we transition into the new information age besieged with inflationary and energy crises.

Ethnotronics is the new field of studying and designing electronic devices that have interactive cultural characteristics, shared with people and other systems. Electronic developments of the 1980's, in the form of ethnotronic systems could bring the golden age of humanitarian computer technology and the advent of computer culture.

The core of ethnotronic systems is a semiconductor unit, which allows information to be discussed and stored so that it can be put to use to amplify human (or other) system functions. Silicon chip microprocessors are the information units most used today for creating modern people amplifier appliances.

Ethnotronics definition: The science of the relationships that humans and society have with inorganic systems which amplify their mutual capacity for learning, reasoning, decisioning, accessing information/knowledge, and communicating.

A future history map of first and second generation ethnotronic people amplifier appliances is depicted (in Table 1) to wend its way throughout the 1980s and into the 1990s. Besides application primitives and primitives for each profession (beyond mathematician primitives of the calculator type of add, subtract, multiply and divide), primitives from the developing field of artificial intelligence can also be expected to be added before 1990 such as outlined in Table 2.

The primitives designed for people amplifier appliances (and general purpose program and universal application primitives previously outlined) will also find application in classical systems, such as being embedded into computers to make them smart. Thus the trend initiated by the embeddable microprocessor can be forecasted to expand greatly in the 1980 decade. Embeddable smarts will come in many forms as shown in Table 3.

Such people amplifier appliances, combining communication capabilities with computer intelligence, will establish an ethnotronic culture in which people will communicate with appliances. Appliances will start conversations with people to make them currently aware that information/knowledge is available (from the machine) to help - and appliances will talk (communicate) with other machines in cooperative modes. Thus, such people amplifiers produce to new cultures or "ethnic" groups, i.e., amplified humans and smart communicating/cooperating machines. Ergo electronic cultures are created, and therefore the coined word "ethnotronics" was created by Professor Arthur Harkins at the University of Minnesota to name this newly developing area.

Table 1. The Silicon Revolution: What Will Its Future Bring? - Ethnotronic Systems and Solid State Clutures

PEOPLE AMPLIFIER APPLIANCES	
1st Generation	Toward 2nd Generation
Smart Machines	Smart Systems
Book-On-A-Chip	Library-On-A-Wafer
Mis-On-A-Chip	Office-On-A-Wafer
Course-On-A-Chip	School-On-A-Wafer
Doctor-On-A-Chip	Info-Factory-On-A-Wafer
Manager-On-A-Chip	Institution-On-A-Wafer
Teacher-On-A-Chip	Future World(s)-On-A-Wafer
Politician-On-A-Chip	Cultures-On-A-Wafer
•	•
•	•
•	•

Table 2. Future Expert Knowledge Based Systems Based Upon Artificial Intelligence (AI) Algorithms/Primitives

ADVANCED AND INTEGRATED AI PRIMITIVES FOR
Uninitiated Expert Systems
Rule Based Systems
Symbolic Descriptive Systems
Deductive Reasoning Systems
Inductive Discovery Systems
General Domain Knowledge Systems
Specific Domain Knowledge Systems
Structured Development Automation
Situational Assessment Systems
Problem Solvers

Table 3. Smart Machines 1980 Decade Computers

IMBEDDABLE TYPE

- Smart Computers
- Smart Cybernetic Primitives
- Smart Convivial Interfaces
  - Ease-Of-Use-Functions
  - "Teach-Use-Of" Functions
  - "Agent" Functions
- Smart Machines

PEOPLE AMPLIFIER APPLIANCE TYPE (BEYOND CALCULATORS)

- Smart Pseudo-Professional Amplifiers
- Societal Knowledge Access Devices
- "Experts" Cast As Tools

INTEGRATED SYSTEMS TYPE

- Smart Transportation Vehicles
  - Smart Accidentless Cars
- Smart Micro-Factories
- School-Of-The-Future
- Office-Of-The-Future
- Smart Cooperating Systems
- Distributed Smart Machines

Table 4. Component Computers Programs/Machines/ Systems-on-a-Chip/Wafer

INITIATION DATE		COMPONENT SYSTEM ARCHITECTURE
1980/81	-	Component Processor Era Microprocessor-On-A-Chip Component Application Primitives
1981/83	-	Component Computer Era Miniprocessor-On-A-Chip Small-Scale Component Programs Microcomputer-On-A-Chip
1983/85	-	Component Memory Era Medium-Scale Processor-On-A-Chip Medium-Scale Component Programs Minicomputer-On-A-Chip Memory System-On-A-Chip
1985/88	-	Component System Era Large-Scale Processor-On-A-Chip Large-Scale Component Programs Medium-Scale Computer-On-A-Chip Mass Memory-On-A-Wafer Multi-Microcomputer System-On-A-Wafer
1988/92	-	Component Multi-Systems Era Large-Scale Computer-On-A-Chip Library-On-A-Wafer Multiple Large-Scale Systems-On-A-Wafer Future Office-Of-The-Future-On-A-Wafer Future School-Of-The-Future-On-A-Wafer

In order to properly discern the currently incalculable benefits of the next wave of hardware developments, consider the near term turning-point of placing a complete computer, process, machine or system into a single chip. Already microprocessors are emerging in single chip form, soon microcomputers will leave the drawing board and become a reality as a system building block component. What is forecasted to follow in the 1980 decade if we extrapolate this trend? In Table 4, a future history map is outlined forecasting one very likely trend for future hardware components of the VLSI (and beyond). Further, notice how the task of the engineer changes from designing with logic and memory, to designing with machines and parts of programs, to large-scale machines and total programs, to systems and finally with electronic institutions like libraries, offices and schools (etc.) as components or basic building blocks for making large systems. Have our schools, and computer education, prepared us for such a massive transition in computer design changing into designing future institutions?

Coming upon the back stretch of this paper, the point has been reached to ask (but not to necessarily answer) some questions relative to the future computer architectures that this didn't cover, such as:

- What are the primitive functions of future computers (which go beyond extensions of current computer functions and computer instructions)? This paper indicated that there is a multitude of new directions to consider for inclusion.
- What happens (to the infrastructure of society) when you can wear or carry a library or a school or an office, or machines which have embedded such component institutions, and have real-time access to societal knowledge?
- What happens to individuals and society collectively when machines like computers are smarter than people?
- What future societal alternative opportunities can be forecastable for world peace, raising the standard of living (etc.) that become possible as new computer architectures emerge from the research laboratory into usage?
- What happens when computers become as friendly and easy to use as a pair of eyeglasses?

HIGHER EDUCATION'S RESPONSE

Thomas Wright	Human Productive Activity: A Base for Industrial Arts
Stephen Cutcliffe	Technology Literacy for the Non-Technologist
Myron Bender	Transportation Technology in a Technology-Based Industrial Arts Program
John Entorf	Promoting University - Industry Interaction

Thomas Wright
Ball State University
Muncie, IN

HUMAN PRODUCTIVE ACTIVITY: A BASE FOR INDUSTRIAL ARTS

We face a crisis - a crisis caused by a misdirected mission, inappropriate content and narrow methodology. Today, as never before, industrial arts stands on the threshold of making a truly significant change in direction. The field seems to be ready to finally abandon Calvin Woodward's manual training emphasis on the skills of the draftsman, the woodworker, and the metal worker.

But in what direction should we turn? How should we face the crisis? The most promising avenue seems to be one which accepts the central mission of industrial arts as "the development of an understanding of industry and its associated technologies and the social-cultural impact of the industrial/technological aspect of the society."

This mission provides a basis for developing a unified content with a central overriding theme - that of Human Productive Activity. All human productivity activity involves transforming - the transforming of materials into manufactured products through the act of **Manufacturing**; the transforming of materials and manufactured goods into constructed structures and projects through **Construction** activities; the transformation of information into media messages using **Communication** techniques; and the transforming of energy into power to provide for relocating goods and people using **Transportation** systems.

The universals of all of these systems involve (1) the design of the product or system, (2) the preparation for transformation of inputs, (3) the transformation of imputs into outputs and (4) the marketing of the outputs. Since all four of these systems have primary and secondary **inputs**, contain a **process** component, produce a desired **output**, they may be seen as **Production Systems**. However, for this paper the term "production" will be limited to manufacturing and construction.

The production system makes its greatest impact as it is operated by industrial enterprises. Businesses provide the vast majority of the manufactured products and constructed structures and projects which make our lives more comfortable. These enterprises have two important features related to the four step transformation act - they are managed activities and they are responsive to human and society needs, wants, and pressures.

Humans plan, organize, direct, and control Research and Development, Production, Marketing, Financial Affairs and Industrial Relations Activities. This managed system responds to human needs and wants, market pressures, environmental concerns, government regulations, and a myriad of other social/cultural/political forces.

To show this system more clearly and describe its application to industrial arts, a model manufacturing program will be presented. To fully understand the act of manufacturing two major technologies must be studied - material processing technology and management technology.

The study of material processing involves experiences in the technology associated with changing the form of materials to add to their worth. These experiences should develop a knowledge of the types and characteristics of materials and an understanding of primary and secondary processing techniques.

The study of management technology develops an understanding of the efficient and ap-

propriate actions necessary to build products in quantity. This activity involves a managed system which has discrete areas of activity that are planned, organized, directed and controlled by people having varying levels of authority and responsibility.

The material processing and management technologies take on meaning as an enterprise. The production or manufacturing company or companies are characterized as industrial enterprises. Therefore, a study of the human productive enterprise called manufacturing involves the study of technology (the knowledge of efficient and appropriate action) and industry (the societal institution designed to provide for human material wants and needs).

Figure 1 shows a typical structure for the study of manufacturing. This model suggests that material processing technology should be presented first followed by management technology. The knowledge developed during these first two phases are then applied in a dynamic, real-life simulation - the student centered enterprise.

This model may be applied to the other areas of human productive activity. Construction, Communication and Transportation all use process technologies and management technologies. They also are applied to economic activities called enterprises. Therefore the Human Productive Activity Model with its process/management technologies and enterprise components provide an answer to our crisis of misdirected mission, inappropriate content, and narrow methodology. It also fuses together the study of technology and the study of industry. Certainly this approach deserves serious consideration as a replacement for the Calvin Woodward model for Industrial Arts.

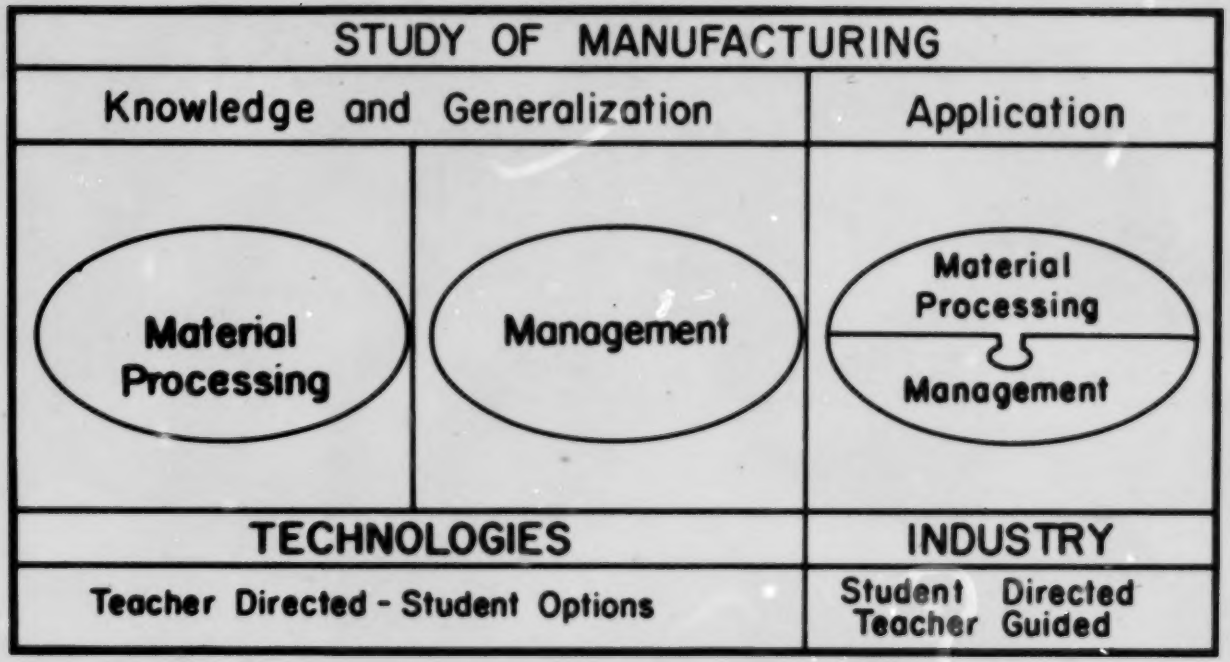

FIGURE 1 : MANUFACTURING PROGRAM STRUCTURE

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"TECHNOLOGY LITERACY FOR THE NON-TECHNOLOGIST"

1980 marked the end of a decade of steadily increasing interest in the interactions among science, technology, and society, an interest that has come to define the Science, Technology and Society (STS) field. To date, there are over 200 formal academic programs and at least an equal number of informal course clusters serving this area of interest at every level of higher education programming. Concurrently, an increasing number of journals and newsletters have come forth to service these programs, providing an outlet for research actvity and information dissemination. In spite of this steady growth, it remains the case that the majority of STS courses are located within liberal arts colleges or in the humanities and social science departments of engineering institutions. While these courses provide valuable humanistic and social science interpretations, both of the roles played by science and technology in shaping contemporary society and of the roles played by social institutions in shaping the directions of scientific research and technological development, very few directly address the issue of technological "literacy." That is, few STS courses seek to present the central elements of engineering, seek to explore in detail the distinction between technology and engineering. Technology is a social process in which abstract economic, cultural and social values shape, develop, and implement specific artifacts and techniques that emerge from the distinct technical problem-solving activity called engineering which is embedded in that process. An approach that starts with an analysis of engineering concepts and engineering techniques is especially important for the non-science/engineering student in today's high-technology society. In this sense, 1980 also marked the opening of a new decade of opportunity for STS curriculum development focused on the elements of engineering.

Lehigh University has developed an extensive STS curriculum during the past decade, but like most other institutions, the majority of our courses are taught by humanities and social science faculty. Although we have long had the intellectual support of our College of Engineering and Physical Sciences, this has normally taken the form of guest lecturing and of service as resource personnel for humanist and social science faculty, rather than full-time teaching of STS courses by engineering faculty. Perceiving this as an increasingly serious gap in our own STS Program, we sought external assistance for the development of a package of new courses that would be taught by senior science and engineering faculty.

Recently, the National Science Foundation's Comprehensive Assistance to Undergraduate Science Education (CAUSE) Program awarded Lehigh a $240,000 grant in support of a three-year project to develop six new courses designed with a view to providing students who do not plan on majoring in science or engineering a means of becoming familiar with the basic elements of engineering and applied science and of their incorporation into modern high-technology society. A separate "gateway" course, not funded under the CAUSE grant, entitled INTRODUCTION TO TECHNOLOGY is presently being developed by Dr. Adrian Richards (Professor in the Departments of Civil Engineering and Geological Sciences and Co-director of the project). This course will provide liberal arts and business students with an understanding of the unique and complementary elements of engineering without using mathematics. In particular, techniques such as decision analysis, planning and design, risk analysis, modelling theory, cost-benefit analysis, and systems engineering are examined. Emphasis will be placed on showing how engineering provides technological solutions to problems in a high-technology society,

while at the same time being constrained by societal parameters, e.g., economic, legal-political, or moral constaints. This course is planned to serve as an integrative function for the more specialized courses to be developed with the NSF CAUSE support.

The six specific courses to be developed under the CAUSE grant will include:

1. Computer Modelling of Socio-Economic Systems
2. Chemistry for the Consumer
3. The Regulation of Public Safety
4. Urban Design and the Skyscraper
5. Mineral Deposits, Industrial Development, and World Affairs
6. The Factory of the Future

The set of seven courses, one general and six specific, will offer students, especially those not planning to major in science or engineering fields, an opportunity to acquire an understanding of the fundamental elements of engineering. At the same time, those science and engineering students who take the course will benefit from a clearer understanding of the social context of their disciplines. The challenge as well as the excitement of the project lies in the necessity of developing courses which teach substantive technical concepts in a qualitative manner so that they are understandable to the non-quantitatively-oriented liberal arts students.

Others considering similar curriculum development should be aware of a number of potential problem areas including: faculty recruitment - a particular problem if a given school has no engineering faculty; questions of incentive-tenure and promotion; a general lack of adequate textbooks; liberal arts student backgrounds will generally be non-quantitatively oriented; course credits - should students receive engineering, science or social science credits?

Answers to these questions and many more will most likely be very specifically related to the needs, opportunities, and interested faculty at each given institution. Definitive solutions are not presently available and probably never will be.

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TRANSPORTATION TECHNOLOGY IN A TECHNOLOGY-BASED INDUSTRIAL ARTS PROGRAM

How should the subject of Transportation Technology be incorporated into a Technology-based industrial arts program? To answer this question, a starting point should be a general definition of the term "Technology" itself.

Common usage, as reflected in dictionary listings, unfortunately provides an inadequate response. A more satisfactory formulation has not been provided by the emerging intellectual discipline of the philosophy of technology (1). While it is somewhat opaque to the laymen and probably too simplistic for philosophers, I find the following definition useful:

> Technology refers to systems and artifacts incorporating knowledge of the physical and social worlds which affect society's activities and organizations. (2).

Based upon the above definition, we can conclude that technology is an essentially human endeavor and shares all the intrinsically cultural aspects of human pursuit in designing and developing technical adaptive systems.

Transportation: A Human Adaptive System

Transportation is a technical adaptive system designed by the people to efficiently utilize resources to obtain time and place utility and to attain and maintain direct physical contact and exchange among individuals and societal units through the movement of materials, goods and people.

The content for technology-based industrial technology program is drawn from the knowledge of human adaptive systems and technical endeavors created to extend human potential. The human technical endeavor of transportation involves man's means of transported goods and people from one place to another (3). In reality, transportation is no more than a linkage or a simple expediter of accessibility. Like communications, it is just one method of joining human activities.

Transportation is not a function that stands apart from other socio-technical systems. A socio-technical system, as defined by Kline (4), is a system which includes interrelated social and technical components. The system is generally goal-directed and includes elements such as: (a) people, (b) technics, (c) social organizations, (d) ideological bases, (e) resources of materials, (f) available energy and (g) information. These are common elements related to all socio-technical systems.

Transportation Interface With Communication and Production

There exists a direct interface between the transportation and communication socio-technical systems. Together they encompass the important human activities of mobility and interaction. In one sense, the subject involves the transportation of people and freight and the transmission of information. While on the other hand, all systems of transportation rely heavily on communication technology for control and guidance fo individual vehicles and transport networks (5).

In the long term, advances in telecommunications technology may have a substantial impact on the path of evolution that transportation takes in future developments. For example, a continuation of the current pace of technological improvments in telecommunications might decrease the demand for transportation to and from the work place by permitting a significant number of workers in information-related business to work at home or in remote centers (6).

The relationship between transportation with the socio-technical system of production is also common. Development of an adequate transportation system is essential to a nation's economic progress. As an integral part of production and distribution systems, an adequate transportation network is necessary to provide a means for market exchanges.

Elements of Transportation

Transportation itself is derived from the demand for other activities within a society. Not only is it strongly influenced, but it also propels social and economic developments. Yet these transportation innovations are highly interdependent variables. This interrelationship includes three basic elements: (1) human mobility; (2) activity-movement of goods and people; and (3) physical technologies (Figure 1). The properties and characteristics of the human mobility and the physical entities form a complex human machine system. The human elements and the physical (non-human) elements interact through a series of activities for a common set of purposes.

THREE ELEMENTS OF TRANSPORTATION

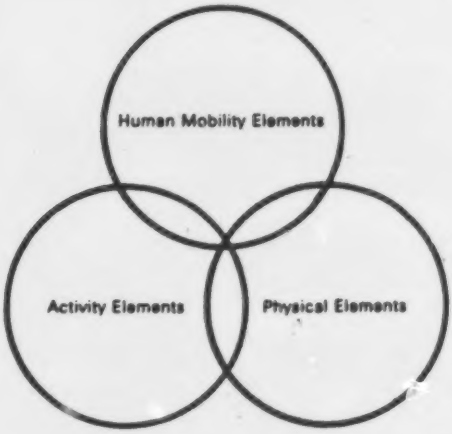

Figure 1 Human, Activity & Physical Elements Interaction.

Transportation: A Productive System

Transportation can be conceptualized as a productive system on the basis of having inputs, processes and outputs (Figure 2).

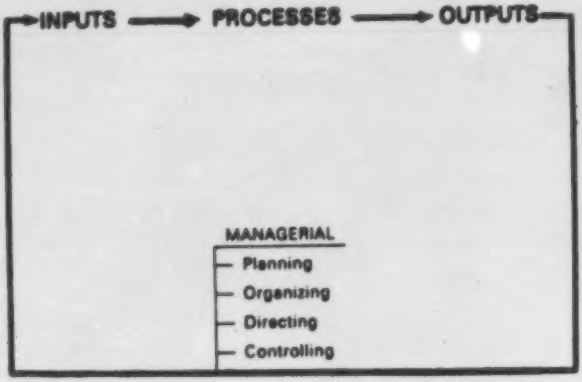

Figure 2 Transportation Input-Process-Output Model

The "inputs" to the system provide all needed resources to accomplish the goals of the system (Figure 3).

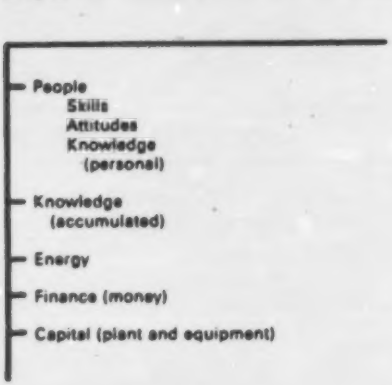

Figure 3 Transportation Inputs

The "processes" are the means (the appropriate means) of bringing about system goals using the inputs (resources) (Figure 4).

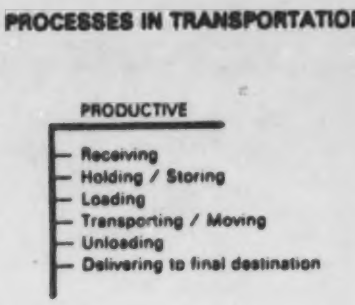

Figure 4 Transportation Productive Processes

The "outputs" of the system include the ends or goals (products, services, or desired results) as they become parts of the newly accommodated environment within the socio-cultural context (Figure 5).

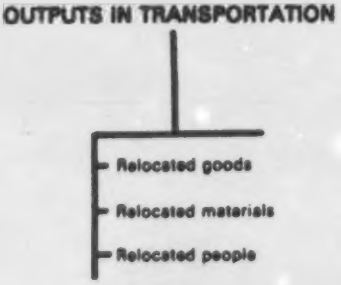

Figure 5 Transportation Outputs

When conceptualized as a productive system, it must be analyzed within the context of the ideological, sociological, and technological concerns of people. It should involve the steps of **planning** to perform the task; **organizing** to transport goods/materials and people; **directing** to issue efficient transport operations; and **controlling** the vehicular and nonvehicular modes and systems to optimize results. Through these managerial tasks, it can be monitored to meet the goals of society. It should be noted that when one develops curriculums, the common conceptual area of the technical adaptive systems must be integrated with the unique productive and mangerial processes of the transport system.

Selection Content For Transportation Technology Education

The implementation of a transportation curriculum in a technology based industrial arts program can contribute significantly toward technological literacy to cope with change and contribute to the progression of society. A program that will provide technical and socio-cultural concepts and principles within the context of a total socio-technical system of transport, will allow students to develop values, insights, and an awareness of self and the world to bring forth the questioning human (Figure 6).

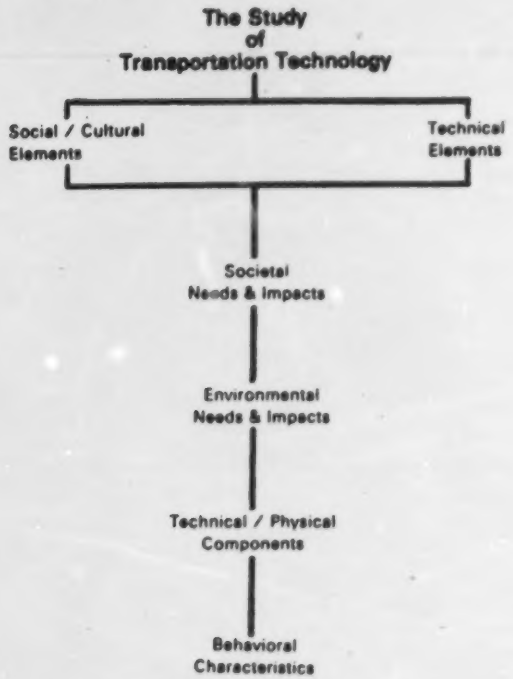

Figure 6 Study of Transportation Technology

In Technology-based industrial arts programs we have the unique challenge to teach not only the technical elements of transportation, but also connecting socio-cultural elements to grasp the totality of a system.

As we are reminded almost daily, a major educational challenge of our time is the development of the human capacity to shape wisely and learn to control a rapidly changing modern technologicl society. This is a critical need, which must be met in part through education. Since transportation technology is a vital component in every society, appropriate curricula should be implemented within the industrial arts education programs in order to move toward meeting this need. Indeed, preparing people for joining a technological society as capable and efficient "decision-makers" is a basic educational problem confronting today's society.

A curriculum for the study of transportation technology must be broad and comprehensive. We can not afford to limit course content solely on the "state-of-the-art" of the technical elements used in transporting goods and people. Rather, the technical elements must be viewed as one component of many involved in the total "socio-technical system" of transportation as it relates to four environmental mediums: (1) terrestrial; (2) marine; (3) atmospheric; and (4) space, (Figure 7).

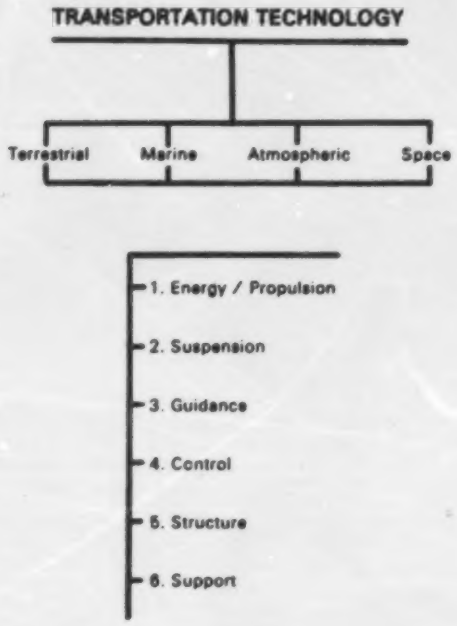

Figure 7 Transportation Technology

Summary

The study of transportation technology in industrial arts education should focus on the sum of humankind's technological endeavors in this area. The course of study should include an analysis of the transportation system, its major components, their characteristics, and how the system functions as a whole within each of the four major environmental mediums (terrestrial, marine, atmospheric and space). In addition, the study should cover the relationship between the transportation system and its environment, one of satisfying the human need for transport and also of producing various environmental impacts and consuming valuable resources. These characteristics of transportation systems and their environments provide the essential basis for the analysis of the various types of transportation problems.

The challenge for industrial arts educators is to carefully select relevant, up-to-date technological-societal issues related to transportation and through proper learning activities prepare young people for joining a society as capable and efficient "decision-makers" for social action. This action will enable us to make use of transportation technology and control it for the benefit of humankind in the future.

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PROMOTING UNIVERSITY - INDUSTRY INTERACTION

We live in a technological society. What we do and how we live are governed by technology. All of you here today arrived via a technological wonder — an automobile, an airplane or combination of both. We live in houses that have automatic comfort control, garbage disposal and other labor saving aids. Many of us recall the "good old days" with nostalgia and wish we could return to simpler times. In truth, we would opt out of those simpler times if we were faced with coal-oil light, wood or coal heat and late night visits to the outdoor privy. For all its faults, technology has brought us many blessings.

America today is faced with several interrelated problems: falling productivity, declining technological innovation and problems in basic research and development; where once we were undisputed leaders in basic research and technological, we are now seriously challenged by a number of other countries. The reasons for this decline are several. Among those cited are: economic and trade policies; environmental, health and safety regulations; tax policies and venture capital formation; federal procurement policies; federal regulation of industry structure and competition; federal support of R & D, ad infinitum.

Prior to World War II, there were close bonds between university research activities and the industries which made use of them. The increased Federal role in research initiated during that war was later fueled by Sputnik and the space race. As a result, universities looked to the federal government for the bulk of their research funds and not to industry. The increased Federal role governed the scope and direction of research and reduced industry's role in basic research. Availability of Federal dollars meant scholarships, faculty appointments, prestige associated with substantial research projects and potential for advancement, all of which reduced the emphasis on industrial research. The recent decline in federal funds to support universities and research programs, coupled with the problems of productivity and innovation, have caused universities to reassess their position relative to interaction with industry. The trend today is toward funding mechanisms that enhance the ability of universities and industry to work cooperatively.

Most of us in this room do not represent programs that are orientated to basic research. Neither do we represent engineering programs which have been the traditional link between discovery of new knowledge and introduction of products in the market place. However that should not deter us, because we have something highly desireable in industry — an ability to apply, to do, to produce not readily available in university programs these days.

Technology based programs face problems similar to those of science and engineering: a need to maintain up-to-date instructional programs; make instruction relevant; maintain faculty expertise; secure industry support; and assess their graduates preparation, to name a few. Close ties with industry can provide assistance in these areas, and there are a number of ways to promote those ties: (1) faculty consulting, (2) endowed chairs, (3) unrestricted grants, (4) co-op or internship programs, (5) capital contributions and (6) research activities.

The University of Wisconsin-Stout has chosen to emphasize the latter as a mechanism to promote ties with industry through the establishment of its Center for Innovation and Development. Of the several possibilities, this one promises the greatest long-term return, even though it may be more difficult to establish. The probabilty of success is great because the benefits accrue equally to the university and industry.

Establishing a research organization requires consideration of several factors:

- Function of the University
  - Teaching
  - Service
  - Research
- Function of "The Center"
  - Contribute to education of students
  - Enhance faculty development
  - Promote new technology
- Organizational Structure to Promote "Functions"
  - Extension of university function
  - Interface with industry
  - Integrate industrial projects with educational programs
  - Coordination with other agencies
  - Maximize use of university facilities, etc.
- Operational Policies
  - Criteria for project acceptance
  - Project direction or control
  - Authority to sign contracts
  - Charges for university facilities, assignment of faculty time
  - Publication and confidentiality
  - Ownership of inventions and innovations

As in any new venture there were problems — some small, some large. All of them can be solved with persistance and a willingness to look for alternative. Those areas that have caused us the greatest concern, principally because they are new and strange are:

- Contracts — legal document that establishes the rights and responsibilities of both parties.
- Inventions/Innovation and patent rights.
- Licensing and royalties for patents or know-how.

JUNIOR-SENIOR HIGH SCHOOL EXEMPLARY PROGRAMS

Robert Daiber Dale Gerstenecker	Implications of Technology at the Secondary Level
Gary Wendorff	Developing High School Technology Programs - Articulation
Fred Posthuma	Developing High School Technology Programs
Robert Hendricks	Activities in Technology Education
Bruce Barnes	Teaching Technology at the Junior High Level

Robert Dalber and Dale Gerstenecker
Triad High School
St. Jacob, IL

IMPLICATIONS OF TECHNOLOGY AT THE SECONDARY LEVEL

Identifying the major implications of technology at the secondary level is an initial step in developing technology-based instruction for secondary school programs. Presently many secondary industrial arts programs focus on technical skill development for occupational preparation. The knowledge students acquire from such traditional programs is becoming less beneficial to their secondary education because many technological developments have occurred the past two decades and rendered a part of traditional subject material obsolete.

Implication 1: Subject matter for technology education should remain relevant to the development of new technology.

As we experience technological change, we should be aware that new technical developments revise industrial practices, create new occupations, amd make impacts on society. These factors of technological change need to be included as a part of the subject matter at the secondary level. Students need to be knowledgeable individuals aware of new technical developments, social-cultural issues, and occupational frontiers which are evolving as a result of technological growth. A technology education can provide students with an opportunity to acquire the following:

1. A general understanding of technology - defining what is technology, explaining how technology is developed, understanding what technology is appropriate for human usage, and determining the cause and effect of technological change.
2. Technical skills - the ability to correctly use modern tools, machines, materials, techniques, and technical information.
3. Social-cultural skills - the capabilities to make decisions, solve problems, communicate, and cope as a consumer, citizen, or employee in a changing world.

Implication 2: Curriculum design for secondary technology education can be constructed in a variety of forms, but all should include technology as the subject-matter base, be balanced programs, and involve secondary teachers as part of curriculum development projects.

Today many people may agree and see a need for technology education at the secondary level; however, they may be uncertain of the means in which to develop a technology curriculum for their public school. Research, provided by Bensen at Symposium '80, implied that a variety of curriculum approaches exist from which public school programs may be developed. These approaches are the conceptual approach, behavioral approach, societal approach, transactional analysis approach, and systems approach. (Bensen, 1980, p.4)

Several curriculum experts were interviewed by the *Man Society Technology* journal, (Dec. 1980) and implied that recent curriculum movements in the profession could have been conducted better if the plans would have done the following:

1. involved teachers at the local level; (DeVore, p. 9)
2. balanced the three principle elements of curriculum or program development (the content area, the societal framework in which the programs functioned, and the human or personal need component); (Maley, p. 9) and

3. established technology as the subject-matter base of the profession at an earlier date. (Ray, p. 9)

Implication 3: Secondary teachers need to become involved in changing their traditional programs to help make the transition to technology education.

More industrial arts instructors might become involved in developing secondary technology programs if they can identify themselves in the role of curriculum developers. One secondary technology education program which was developed by public school teachers is the Triad Technology Education Cluster at Triad High School, St. Jacob, Illinois. This program was redesigned as a group effort of the school's industrial instructors. The result of the instructors examining their program broadened traditional subject areas to include more relevant content, clustered courses in a meaningful structure, and organized instructional material into three sequential levels. To transform from industrial education to technology education entailed the following procedure:

- Introducing technology content in traditional classes
- Discussing change in industrial arts
- Agreeing to revise the industrial arts curriculum
- Developing a technology-based program for secondary education
- Presenting the program to a school curriculum committee
- Getting approval from the Vocational and Technical Council
- Seeking ratification from the Board of Education
- Securing state funds
- Educating the student body about the curriculum change
- Establishing public relations
- Beginning the new program

Implication 4: Instructional strategies for secondary technology education should be technological in nature.

The means of instruction used to provide students with a technology education needs to be technologically based if students are to understand the technical and social-cultural elements of technology. Instructors may choose to use the project method, research-oriented instruction, and other instructional strategies such as lectures, assigned reading, written assignments, field trips, etc. in their attempt to educate students about technology. Whatever means of instruction teachers select to apply in their classroom, the teaching technique should include technical and social-culture subject matter to be technological in nature.

Teaching technology at the secondary level is an opportune time to increase the technological literacy level of the majority of young adults in our society. Since a percent of high school students never pursue further education after graduation, it is important that secondary education provides students with relevant technical and social-cultural skills. Students who graduate from high school with a degree of technological literacy will be better prepared to help progress and maintain a democratic society during the technological era. Industrial arts educators can contribute to student development, as well as the development of our society, by making technology the subject-matter base of their secondary school programs.

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Gary Wendorff
Clintonville High School
Clintonville, WI

DEVELOPING HIGH SCHOOL TECHNOLOGY PROGRAMS/ARTICULATION

Why Articulation?

Development of new programs or evaluation and alteration of existing curriculum can be a time-consuming effort when approached individually, resulting in a strong resistance to change. The concept of curriculum articulation between individual educators or institutions offers an opportunity for new program development or updating of offerings with less individual time spent. Articulation offers: (1) a stimulus (2) encouragement (3) new ideas (4) shared resources (5) positive criticism.

What Is Articulation?

The term "articulation" as used here can be defined as a joint effort, through cooperation and communication, to develop and unify program objectives. Articulation can be carried beyond objectives to development of course materials, activities, and evaluation.

An Articulation Example:

The Drafting Articulation Project (DAP) undertaken in the Fox Valley Technical District utilized a model for articulation developed by Dr. Stanley Spanbauer of Fox Valley Technical Institute. The purpose of DAP was to articulate drafting programs between area high schools and Fox Valley Tech. Desired outcomes of the project were: (1) to develop a unified list of competencies and objectives, based on current technology, that can be drawn from to develop drafting programs in the technical district, and (2) to develop a management system that would standardize evaluation among high schools and eventually lead to a good system for advanced placement in Fox Valley Tech's drafting program.

A comprehensive task analysis of industry drafting and engineering departments was done by DAP participants. The project was worked on over a three year period by participants from six high schools and Fox Valley Tech. Monthly afternoon work sessions along with two separate week-long summer workshops provided the time. Outcomes of the DAP effort were: (1) a competency list, based on task analysis, in the form of a student certificate. (2) a curriculum guide including objectives, lesson plans, sample activities, and evaluation items keyed to the objectives.

Use of the DAP guide may vary from developing new courses to altering existing courses to simply validating existing curriculum. The six participants are now piloting the use of DAP materials.

Summary

Articulation projects can be used at any level, between individual educators or institutions having common objectives, to develop or improve technology programs. Articulation may be ongoing, providing a format for regular evaluation and updating of curriculum.

Curriculum guides and competency certificates from the Fox Valley Drafting Articulation Project (DAP) may be purchased at cost. Direct inquires to:

Ron Zenke, DAP Director
Fox Valley Technical Institute
P.O. Box 2277
Appleton, WI 54913

"BRIDGING THE GAP" implementation manual and correlated sound/slide program by Dr. Stanley Spanbauer may be purchased at cost from:

Fox Valley Technical Institute
Educational Resource Center
P.O. Box 2277
Appleton, WI 54913

Fred Posthuma
Westfield High School
Westfield, WI

DEVELOPING HIGH SCHOOL TECHNOLOGY PROGRAMS

Technology?! Ask most Industrial Arts instructors and you'll find a wide variety of meanings. Some quite simple and others rhetoric in complexity. Also ask them of its importance and most will say yes, it is very important! Then ask how they teach it and a sudden look of wonder or puzzlement appears on their face. "Oh you know . . ." Anyway I'm tired of changing for change sake. I'm still struggling with the concept of industry and mass production!

These and numerous other examples of "why not" seem to permeate the recent push into the technology scene. And in some respects you have compassion for these instructors — and also their students!

Generally, though on a more positive aspect, much interest has been generated toward a push for technology education in our schools. Industrial Arts fits well into providing a base of instruction for technology education. Some even profess that we change Industrial Arts to Technology Education.

The fact does remain though that an external "face lift" of the name does not change the program content and this is where we must begin. It's time to re-evaluate!

At Westfield High School, we have attempted to keep current with what's happening in our ever changing society. Granted, it has not been an easy road, but it is a road in the right direction. Seven years ago we began a cluster program with courses in the Study of Industry, Energy, Materials and Processes, and Communications with advanced courses in the last three. Our basic approach is to teach and have related hands-on activities that deal with the technologists level rather than with a skill orientated tradesman level. We emphasis the process rather than the product, and reflect contemporary procedures involving more technolgical processes.

For most instructors it is difficult to comprehend what such a program looks like and its advantages. On paper everything looks good, but what about real life!

Because of the limited space I cannot go into detail about the program, as I would like to, but invite you to correspond with me by mail, phone or in person and talk of what lies ahead in Technology Education.

Remember, it's everyones future.

Robert W. Hendricks
Wild Rose Public School
Wild Rose, WI

ACTIVITIES IN TECHNOLOGY EDUCATION

There are a wide variety of curriculum changes currently going on in high schools throughout the country. Schools are expanding and updating what had been narrowly defined Industrial Arts classes, to encompass the much broader study of technology. This redirection of curriculum does not imply nor necessitate the end of Industrial Arts being an activity orientated subject. Indeed, the common line joining the traditional Industrial Arts program to the technology based program is the realization of the need for, and importance of, learning activities. What the new programs do necessitate are changes in the types of activities students work on, and possibly the organization and management of instructional activities.

After program goals, course objectives and course outlines have been written, it's time to select and/or develop activities that will make your goals real in terms of what students learn. There are a wide variety of programs, books, course outlines, handbooks, etc. from which to select activities. Once activities are selected or developed a means of managing both students and activities must be developed and the laboratory arranged.

An example of this process as it applies to the Power and Energy program at Wild Rose High School is as follows. The Power and Energy course is broken down into three segments; sources of energy, conversion devices and transmission devices. A list of lab activities were then identified to implement the course outline. The list of activities included the following: 2-cycle engines, 4-cycles engines, Diesel engines, Wankel engines, transparent engines, pneumatics, hydraulics, mechanisms, basic electricity, house wiring, alternative energy systems, Stirling engines and laser technology. There activities were organized into 11, three week stations with activities being developed in-house as well as purchased from a variety of manufacturers.

Students are guided through the required experiments through a number of self-instructional media. At the conclusion of 15 days students must turn in the experiment worksheets and take a cumulative test on the station. Students requiring more than 15 days are encouraged to come in during study halls or before and after school. Students are also provided with a number of optional activities if required work is comleted early. At the end of the 15 day cycle all students rotate to the next station.

In this arrangement all students receive the same lab experiences but in a different order with equipment purchase kept to a minimum as only one of each piece of equipment per station is ordered.

I believe this learning station lab arrangement provides students with a diverse experience in power and energy as well as developing in the student a sense of responsibility and management of his learning experience. A number of other instructional management strategies are used throughout the Wild Rose program.

Although the role of the instructor changes, as well as the type and organization of instructional activities, the important point is that students, involved in meaningful, well organized activities, remain the key to any technology education program.

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Bruce Barnes
Oak Grove Junior High School
Bloomington, MN

TEACHING TECHNOLOGY AT THE JUNIOR HIGH LEVEL

The efficient study of any area, including technology, requires a workable management system. The Occupational Versatility program easily meets the management needs for the study of technology. OV is concerned with what a student learns as well as how a student learns. Along with the development of skill and knowledge, the OV program concerns itself with the development of productivity, adaptability, and self-sufficiency.

The heart of the OV management system is the notebook. The notebook contains sections on how to operate in the industrial arts facility, records of student time utilization and attendance, performance records, and power equipment usage records. The notebook allows us to keep track of a students progress, and individualize instruction to meet each persons needs.

The study of technology could be accomplished with various educational methods. Perhaps the easiest for the instructor and most boring for the student, would be the lecture/demonstration method. Other enlightened instructors use the "research" approach — "go do something and keep busy so you can get a good grade." A better approach is that of Articulated Instructional Development (AID) booklets that have been developed in Canada, or detailed activity packets. The ideal situation would allow students to achieve technological literacy levels through the use of self instructional activities that allow for some creativity of the part of the student, with the instructor available to monitor the process and act as a resource person when necessary.

The problem is that the development of good activities takes time and money. Industry provides some software, but it always seems to be coupled to extremely expensive hardware. Other meetings such as this symposium, result in flowering speeches, and documents such as this one that are virtually useless to the classroom teacher and student on "Monday morning." If we expect the average teacher to "get with the program," then we must provide usable, meaningful, types of activities within the budget or that instructor will **not** be willing to change.

Our program at Oak Grove contains some micro-mini courses, and a great many learning activities that direct the student with flip charts, booklets, or activity sheets. We give students a chance to explore the areas of Manufacturing, Power and Energy, Communication, Transportation, and Construction. We spread the gospel thin — to explore power and energy does not require a 9 week course in 2 and 4 cycle engines.

We believe our program, using the OV management system, allows us to individualize instruction, make more efficient use of tools and equipment, provide students with a wide variety of activities, and allows the instructor to become a facilitator of learning while giving the student a hands on look at technology.

SUMMARY

Wes Face	Technology - Where Are We Going?
Lee Smalley	Postscript

Wes Face
Vice Chancellor of Academic Affairs
UW-Stout
Menomonie, WI

TECHNOLOGY - WHERE ARE WE GOING?

Lee Smalley is a very clever person, who has probably involved me in more activities than most faculty. I'm not quite sure how to read that; perhaps he assumes I have little to do and thus he feels it his role to keep me busy and help create the illusion that the position is necessary. I'm not sure what to think when he puts me at the very last moment, in a symposium that has literacy as a part of its title. I'm not quite sure, either, what to do with the fact that after two stimulating days, on a late Saturday afternoon, when everyone is anxious to get home, that I'm to hold you for a few more moments while he and his team figure out what details still have to be handled. He suggested that I should limit my remarks to 15 minutes because there are a lot of other administrative details to be taken care of. I always appreciate those very positive vibrations, as one prepares for this kind of a session. As I talked to people who have been in attendance throughout the last two days, I'm sensing that this was an extremely vital and important symposium. Unfortunately, I was out of town until noon today, so I couldn't really join you.

I do believe that I have some literacy in this area and, thus, I can give you a couple more last moment things to think about. I assume that most of the speakers in the past two days have felt some necessity to define what they meant by technology, and I assume that these have similarities but significant differences. I, too, feel a necessity to establish what I believe technology means, before making any comments. I have never been terribly happy with the concept that technology was simply the application of scientific principle.

There are too many terms that we have in common usage, called technology, that require great exaggeration to assume that this is the application of a scientific principle. When we talk of management technology it isn't really science that's being brought to apply, but perhaps a knowledge of human conduct. It may be a knowledge of the traditions of an institution, it may be a knowledge of organizational prinicples, it may be fiscal knowledge, it may be many things that we bring to bear to solve management problems. I tend to like the definition that Ohio State dug out for their project, which they refer to as the study of efficient practices. I find that a very effective, simple definition for an otherwise complicated concept, but it can give me some direction as to how I would study it. If merely talking about the application of knowledge, and more specifically, scientific knowledge, this doesn't particularly help me know where to start and where to stop my study of technology. Stout's mission statement also accepts this definition when it suggests that "we provide transdisciplinary programs which center upon the study of human development and interpersonal relationships, the efficient practices of man and industry and education, and the relationship of man to technology, vocation and society." This statement gets at the technological orientation of Stout, as well as an emphasis within the mission's statement, that technology is one of the areas that we study.

I commend those of you who have worked to get this symposium started and continuing. There is probably no more important time in our society's development for us to clearly study the concept of technology. Even without proceeding, I know that Aristotle and Socrates probably said the same thing. Various technological methods of warfare, for example cannons, were destined to destroy mankind. I believe that we have reached a point in our technological development where the total human race can be destroyed, if not the entire earth, by our technological capabilities. Minister Fowler, in his book *Utopian Oblivion*, states that, "Man on earth is now clearly faced with the choice of utopia or oblivion. If he chooses the latter he can go

right on leaving his fate to his political leaders; however, if he chooses utopia he must get busy very fast."

As we know, people can obliterate species through nuclear warfare. It has become terribly apparent that we can also do it through the slow destruction of pollution and other similar, less blatant, methods of obliteration. We have within our capabilities, the ability to alter genetic structures and even to produce humanoids, to alter personalities, to create a totally hedonistic hell on earth, or any of a variety of utopias. It seems to me that whatever future we choose will depend at least partially, if not totally, on the values that we hold and use to make decisions as to which of our technological capabilities we unleash or allow to grow to the ultimate conclusion.

Once having suggested that the choice is ours, and that it will depend upon what we value and give high priority to, this does not necessarily simplify our task. I would hope that these values grow out of appreciation of the alternatives, the impacts, and the various future that are all plausible, and that those value decisions will occur only through logical, rational decisions, rather than emotional ones.

Charles Riech, in his book *The Greening of America*, took that kind of stand when he suggested that the only salvation possible from technological destruction is through formal education. If we agree that education is an acculturation process, a process in which one helps people make wise decisions amongst the multiplicity of alternatives, then it seems to me that there could be no better time than now for schools to carefully study the forces which we call technology. It also seems to me that we should study it from the sense of what are the various alternatives, what are the various points of view, rather than from a partisan, emotional stand point, in which we try to promote the good or evil of certain technologies. It seems to me the student should leave us a very partisan person, who has been exposed to many non-partisan alternative points of view, and thus is prepared to make wise decisions.

As you know, there has been a great deal of emphasis on how we categorize technology as either high, intermediate, or low. I think that the concept of "appropriate technology" has illuminated the need for studying the alternative approaches and possible solutions to our problems that can grow out of understandings of the availability of various kinds of technology. I do not believe it would be appropriate for the school to determine whether or not a low technology resolution to a problem is acceptable, or if it takes a more complex technological solution. The concept of what is "appropriate technology" is an exciting thought, and falls uniquely into what I believe the school should do in the first place: to turn out a graduate who is capable of making appropriate decisions, based on understanding. To assume that we are going to solve the energy crisis through woodburning is not a viable alternative to someone living in the middle of Manhattan.

We know that any study of technology ultimately results in a graduate who has, because of his own particular set of values, made determinations which will guide our society in one direction or another. I think all facets of life actually reflect that people have made choices, and that these choices are apparent as one understands their value system. These are simple statements to make, but with complex issues they are not simple theories to implement. I have a growing concern that the task of helping people be well enough prepared to make technological decisions is becoming an increasingly complex and difficult task. The study of literally thousands, if not millions, of issues associated with the concept of technology is essential. It has always been. Raising the technological literacy of our society to the point where people can make intelligent, wise decisions is a very complicated task.

For example, although I may have very strong feelings about whether or not we should have an atomic plant in this part of the country, my feelings are based almost entirely on very crude understandings of technology. They are based far more upon emotion and the power of persua-

sion of others who do have knowledge, than upon my own knowledge. Thus, I find tremendous confusion in my own mind as to what stance to take on that technology, simply because I find some of the best trained minds in total disagreement as to whether or not atomic energy is a utopian response to the energy crisis, or a track which leads us to the ultimate destruction of the human race. People who have studied this for years, with the most advanced training and education, are in total disagreement. So how should I, if given the opportunity to participate in deciding if an atomic power plant should be located in this part of the country, make a decision.

Minimally, I need to be better prepared technologically to look at this issue and try to ascertain the impacts and consequences of the various alternatives. The schools must help me develop that understanding. With each more complicated technoligcal advancement, the task of making sure that I am prepared to participate in the democratic sense in making decisions becomes extremely challenging.

Ogbern best explained one of the reasons why this is true when he talked of the material and non-material culture. The material culture consists of our technological advancements; our non-material system consists of our value systems. His point was that the technological or material aspect of our culture advances at a more rapid rate than our non-material culture, mainly because technological advances have a multiplying effect. Thus, development in one area triggers and explodes into numerous dimensions in still yet another area. Because of this, my value system (my decision as to whether or not something is as I would like it to be) which is based upon more of an isolated one-by-one form of resolution, trails far behind. At some point, this kind of gap between two cultures leads to a serious problem; the problem is in our allowing decisions which ought to be made by society, being made by the experts. I find a tremendous dilemma in this problem. It's hard to know how people will manifest their behavior under such circumstances, but typically they will fall back on feelings, rather than rational thinking. We find ourselves excusing away certain parts of our rational way of thinking by pointing out that data is not to be trusted; we find a growing suspicion of things that we don't understand.

This leads to a certain amount of disequilibrium, which can be tolerated by some people, but is psychologically unsettling to many. The issues are mind-boggling as one thinks about what is technologically possible. A very recent article in the *Futurist* (which I'm sure many of you subscribe to) by Valaskakis, from the University of Montreal, points out technological capabilities, in the sense of using and abusing the resources of our environment. He offers us three various scenarios and labels them as Conservative Society I, Conservative Society II, and Conservative Society III. He comes down heavily on the side that there is little choice except to conserve.

The general theme of CSI (or Conservative Society I) is "to do more with more." In other words, we must accomplish more, knowing full well that it will take a little more. He would suggest that to implement such a scenario one has to have an underlying belief that material plenty is desirable and that it can be made compatible with the ecology. The implementation of this point of view requires reform and more efficient practices. In other words, more and better technologies. We have to learn to manage our time to be more efficient in our production techniques; we have to consider alternatives like renting more objects, rather than buying them, and more partnerships; and this is all highly possible to implement in North America.

The Conservative Society II, that he refers to, says that we must "do the same with less." This is based on the idealogy that enough is enough, and that there is a ceiling on the amount of material plenty that we can have. To implement such a scenario there would be greater control of consumption and production.

He suggests counter-advertising; that as we advertise and promote the direction that does consume, that we point in a counter-advertisment to the desirability of conserving. He suggests

that in North America, the possibility of implementing such a point of view will require some major value shifts.

The Conservative Society III requires "doing less with less, and doing something else." It is based on the philosophy that the way to happiness is not through material plenty. The strategy to implement this society would be to de-industrialize society, to roll back and attempt to change human wants and needs through human awareness campaigns. He suggests that the possibility of implementing such a scenario in North America is extremely low; that it would require major and significant value shifts.

This is just one model of the various outcomes that can occur, and which we are technologically capable of implementing. From a value standpoint, that is not simple. I'm fascinated by otherwise intelligent people suggesting that all we have to do is to change people's values. Unless we can come up with technology to accomplish that, I'm not sure that is anywhere near as simple a solution as one would promote.

The one thing I come out of all this with, is the need for education to try and help people make the various kinds of decisions that are necessary, to make them aware of the impact and consequences of the decision. We must spend more and more time in our schools studying the impacts of technology. Therefore, the term technological literacy was a good theme for the conference because the number of technologically illiterate people in our society is staggering.

If some of us who have had some interest and made some study of technology for years, have to confess to our lack of a full understanding of some of the technological developments, like atomic energy, than how must a person feel who has had little or no training in this area. As we continue to promote this as a curricular area and an area which must be studied, let me strongly encourage all educators who see this as a desirable process, to begin immediately to figure out how to study the concept of technology, the impact of technology, the consequence of technological decisions, the way in which technological advances can be implemented into a society, and study these aspects of technology, rather than the processes of technology. If we start down the road of trying to study the processes of technology, we will become fundamentally lost in a mirage of specific kinds of understandings that are ever-changing and which we can never expect to fully study. I cannot encourage enough the need to look at the various dimensions of technology from a conceptual, generalizable standpoint, rather than from a point of specific study of processes. Industrial Arts, as far as I'm concerned, in its attempt to study industry, made that error. It is an error which I don't expect us to ever recover. We have bought into the study the industrial processes, and consequently turn out illiterate people when it comes to an appreciation of what industry is about. The same type of approach with technology will mean that we did not live up to our full capabilities. What we must turn out is a populus who understands, can have some full appreciation of the impact of technological decisions so that when allowed to participate in making decisions which advance one technology versus another, will do so from a generalizable set of understandings.To expect them to be made from specific understandings is impossible. Thus when the atomic engineers, the atomic chemists, the atomic physisists cannot decide whether or not atomic energy is good or bad, the schools need not worry about trying to develop in the laymen enough specific understandings to make those kinds of decisions. They will have to be based on philosophical and value loaded issues, and that must be the center of our study of technology, or we will waste enormous amounts of time and energy of ourselves and our students.

Thank you for being here this week end. We hope that this symposium has accomplished its purposes, and strongly encourage you to continue this kind of an event.

Dr. Lee Smalley
Industrial & Marketing Ed. Dept.
UW-Stout
Menomonie, WI

POSTSCRIPT

And so, how was this done?

"I will prepare myself and then I will be ready for the opportunity." This is an old adage, but sometimes still true. The School of Industry & Technology at UW-Stout formed a Technology Study Committee in 1978. With a grant from the Wisconsin Department of Public Instruction, we brought visiting scholars to our campus, bought materials, generally laid the foundation for more specific actions, and were able to meet many times. Five of us attended Symposium I and when the opportunity came, we accepted the responsibility for hosting Symposium II.

Since we were already a functioning group and knew each other well, planning went smoothly and assignments were carried out in a professional manner. There was adequate lead time, personnel, and with a grant from the American Technical Society, some remuneration could be given to speakers and these proceedings published.

And so, what was accomplished?

We hope that people were reinforced by others as to their judgements relating to the future of industrial arts. We hope that people received both information and inspiration that will translate directly into a better educational experience for young people. The social effects of renewing friendships, meeting new people, engaging in a dialogue, and visiting another campus should have a beneficial effect upon the attitude and performance of the people attending.

As you look over our program, you will notice that we included a diverse group of presenters. This was done deliberately—to include people from industry like Earl Joseph and Roy Hyink; industrial teacher educators such as Willis Ray and Myron Bender; other educators, Stephen Cutcliffe and Edward Daub; junior-senior high school teachers, Bruce Barnes and Robert Daiber; ancillary people such as Donna Boben and Gerald Stashak; and observers, Wes Face and Dave Bjorkquist. Technology, regardless of how you define it, is a multi-faceted phenomenon and must be looked at by a variety of people with a variety of "glasses." Marshall McLuhan makes the point that every person has their own idiosyncratic set of goggles and so it is a wonder that so many people agree on so many things, when we all "see" things from a different point of view.

Symposium II kept the momentum going that was established at Charleston in Symposium I. A loose organization of three people has been established to make the few decisions that are going to be necessary. The present Chairman, Lee Smalley, UW-Stout; the past Chairman, John Wright, Eastern Illinois University; and the next Chairman, Tom Wright, Ball State University, will form an executive committee, with the senior chairman presiding. Each year the senior chairman will leave as a new one is identified. This provides for both continuity and change.

And so, what have we learned?

It becomes increasingly apparent there is a deep division in industrial arts as to its direction for future change, as well as the necessity for change. We also learn there are other people who are also searching for answers that will adequately answer the new questions being asked. A local school superintendent retired early and when asked why, he replied, "I found myself giving the same answers to different questions." That is what I call wisdom. Maybe some of us in industrial

arts have been guilty of this, too. We have also learned that the questions: What do we teach in industrial arts? How do we organize this content? To what end are we teaching? are like the fish that must be caught anew each day. These are profound questions and should not be passed off with an easy answer.

We also learn that within a span of a few years, a new generation of leadership will emerge. The pre-World War II (could it be 30 years already?) college grduates who have provided much of the leadership the last 20 years are being replaced. This will cause a shift in emphasis and direction. Speakers at the Symposium reiterated much of what we see and hear around us—that women are moving into non-traditional fields, computers seem to be here to stay, employment in manufacturing will decline, we need to be future oriented, the energy problem is a tough one, kids still like an activity program, publishers will publish what teachers will buy, not everyone agrees technology is the way to go, and that you cannot step into the same stream twice!

And so, where do we go from here?

We go back to our jobs with maybe a different reference, story, idea, or illustration. Maybe we go with a different attitude or resolve toward what we want to do. Maybe we even return with more questions than we started with, or a framework for working toward a solution. We may go with some names for a network of support that is crucial in an endeavor such as this, or maybe we return being very confused and "turned off" because no one had "the" answer. Or maybe we return not being able to sort it all out yet. There is a place for contemplation in the learning sequence.

In the early stages of a movement, it seems that everything needs to be done at once. I will put a priority on three items that I feel are necessary to be worked on before much more progress can be made:

1. **What makes a course technological?**

   The word technology is almost meaningless in the variety of ways it is being used. We will have to exhibit some discipline and some compromise to agree on what it means to be involved in technology education.

2. **What will students be doing in a technology course?**

   Industrial arts is still an activity, shop-based program. I assume it will continue to be so, but we will need some specific examples of what students will be doing to achieve the objectives of the new program.

3. **How are we spreading the message?**

   People who feel that technology education is worthy of their efforts will need to write in the journals, conduct research studies, speak at conventions, write books, draw plans, inform their administrators, explain to students and parents, answer questions, and provide an example, if this movement is to continue to grow and develop in time to help young people handle some of the personal and societal problems that will be thrust upon them.

And so, what is my conclusion?

I feel that this part of the poem, **Postgraduate**[1] sums up my feelings for industrial arts at the present time.

The professors recline in the easy chairs of their
Minds, cavalierly distributing their ideas
Like so many urine specimens to impoverished
Lab technicians. The air is ponderous with
Their overly-masticated words and dessicated
Thoughts. The hours spent with them drag
Like barnacled anchors along a sea bottom.

Teachers of tomorrow,
You far-reaching, super-excellent
Short order cooks for the common denominator,

Lift up the world's dress and look!

[1]Kiesel, Stanley, *The Pearl is a Hardened Sinner*. Charles Scribner's Sons, NY, 1968 (pgs. 63-65).

APPENDIX

Welcome!

University of Wisconsin-Stout, going back to its manual training days, has a proud and significant history in the development of that part of schooling which related to the industrial art. We hope this Symposium II will provide us with the information, ideas, and will to continue this leadership into the 21st century.

Technology is one of the most exciting developments in the 20th century and it behooves us to spend time, at a conference such as this, listening, talking, debating and deciding on which alternative will provide the optimum contribution of industrial arts in the years to come.

On behalf of Chancellor Swanson and the Technology Education Symposium Committee, I wish to welcome you to Menomonie and University of Wisconsin-Stout. I wish to thank everyone who participated; students, secretaries, faculty, speakers, and those who came to listen. We hope your stay here is a profitable one, and that you come back again to visit, and challenge us.

Lee Smalley, Chairman

FRIDAY, MAY 1, 1981

1:00-7:00	REGISTRATION, 115 Tech Wing, Jarvis Hall
2:30-5:00	There will be continuous tours of the campus and demonstrations/presentations.
	"Humanizing Technology" by Dr. Hank Thomas (127 Fryklund Hall)
	"SCORE: Energy Efficient Vehicle" By Dr. Jim Collier (16 Fryklund Hall)
	"Communication" by Dr. Len Sterry (307 Fryklund Hall)
	"Bio-Feedback" by Dr. Bob Hoyt (153 Science Wing, Jarvis Hall)
	"Production Systems" by Dr. Doug Stallsmith (221 Applied Arts)
	"Design/Problem Solving" by Robert Berkemer (110 Tech Wing, Jarvis Hall)
	"Materials and Processes" by Larry Schneider (221 Fryklund Hall)
5:00-6:00	Epsilon Pi Tau Initiation Ceremonies (111 Commons)
6:00-7:00	Social Hour (Cash Bar) (Commons)
7:00	Dinner - Keynote Speaker Dr. Roger W. Staehle, Dean, School of Technology, University of Minnesota, "TECHNOLOGICAL LITERACY-LIVING IN TODAY'S SOCIETY" (Commons)
	Future Symposia Planning Session (Commons)

SATURDAY, MAY 2, 1981

8:00-9:00	REGISTRATION/COFFEE, 115 Tech Wing, Jarvis Hall
9:00	General Session
	"The State of the Art of Technology Education" by Dr. Willis Ray, The Ohio State University (152 Science Wing, Jarvis Hall)
10:00-11:30	"Robotics" by Mr. Roy Hyink, Director of Milwaukee Research, Cutler-Hammer (141 Science Wing, Jarvis Hall)
	"Developing High School Technology Programs" by Mr. Gary Wendorff, Clintonville High School and Fred Posthuma, Westfield High School (153 Science Wing, Jarvis Hall)
	"Technological Literacy for the Non-Technologist" by Dr. Stephen Cutcliffe, Lehigh University, Pennsylvania (152 Science Wing, Jarvis Hall)
	"The Jackson's Mill Curriculum Model" by Dr. Jim Snyder, West Virginia State Department and Dr. Jim Hales, Fairmont State College, West Virginia (140 Science Wing, Jarvis Hall)
	"Technological Literacy and the Female Student" by Donna Boben, Vocational-Technical Division, Minnesota Dept. of Education (151 Science Wing)
11:30-1:00	Lunch (110 Tech Wing, Jarvis Hall)
1:00-2:00	"R & D, Inventions, Patents" by Dr. Don Schultz, 3M Company, St. Paul and Dr. John Entorf, University of Wisconsin-Stout (147 Science Wing, Jarvis Hall)
	"Implications of Technology at Secondary Level" by Mr. Robert Daiber and Mr. Dale Gerstenecker, Triad High School, St. Jacob, Illinois (152 Science Wing, Jarvis Hall)
	"Transportation Technology Education" by Dr. Myron Bender, University of North Dakota (141 Science Wing, Jarvis Hall)
	"The Understanding of Technology in Human Affairs" by Dr. Edward Daub, University of Wisconsin-Madison (140 Science Wing, Jarvis Hall)
	"A Publisher's Role in Technological Literacy Education" by Mr. Gerald Stashak, Davis Publishing, Inc., Worcester, Massachusetts (153 Science Wing, Jarvis Hall)
2:00-3:00	"Technological Literacy and a View of the Future" by Dr. Earl Joseph, Univac, St. Paul, Minnesota (141 Science Wing, Jarvis Hall)

"Teaching Technology Activities at the High School Level" by Mr. Bruce Barnes, Oak Grove Junior High School, Bloomington and Mr. Bob Hendricks, Wild Rose High School (140 Science Wing, Jarvis Hall)

"Production Technology" by Dr. Tom Wright, Ball State University (152 Science Wing, Jarvis Hall)

"A Critical View of Technology Education" by Dr. Dave Bjorquist, University of Minnesota (153 Science Wing, Jarvis Hall)

"The Role of Technical Schools . . ." by Mr. William Mamel, Hennipin County Technical Institute (151 Science Wing, Jarvis Hall)

3:00 Wrap-up - Vice Chancellor Wes Face and Dr. Lee Smalley, UW-Stout (152 Science Wing, Jarvis Hall)

TECHNOLOGY EDUCATION SYMPOSIUM II
STEERING COMMITTEE

Chairman: Lee Smalley, Industrial and Marketing Education Dept.

Jim Bensen, Dean, School of Industry and Technology

Jim Bjornerud, Undergraduate Program Director, Industrial Education

John Entorf, Chm. Materials and Processes

Len Sterry, Graphic Communication

Bruce Siebolt, Assn't Chm., Business and Industrial Management

Marvin Kufahl, Materials and Processes

Richard Peter, Industrial and Marketing Education Dept.

Richard Gebhart, Chm. Industrial and Marketing Education Dept.

Glenn Gehring, Materials and Processes